PB89-225502

Superfund Record of Decision (EPA Region 5)
U.S. Aviex, MI. (First Remedial Action), September 1988

(U.S.) Environmental Protection Agency, Washington, DC

7 Sep 88

U.S. Department of Commerce
National Technical Information Service
NTIS

United States
Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-88/073
September 1988

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EPA

Superfund Record of Decision:

U.S. Aviex, MI

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SUPERFUND RECORD OF DECISION
U.S. Aviex, MI
First Remedial Action - Final

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U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/000

14.

15. Supplementary Notes

16. Abstract (Limit: 200 words)

The six-acre U.S. Aviex site is located in the City of Niles, Howard Township, Cass County, Michigan. The site lies in a residental neighborhood with single family homes 100 feet to the south, east, and north. Because there are no storm or sanitary sewers nearby, surface runoff from the site and surrounding areas flows toward Bome-Huntly Drain, a tributary of St. Joseph River, and ultimately Lake Michigan. U.S. Aviex produced non-lubricating automotive fluids from the early 1960s until 1978. During operations at the plant, chlorinated hydrocarbons, including trichloroethane (TCA), were released into the vadose zone south of the process room. The subsurface soil still contains significant quantities of TCA, TCE, and PCE. In July 1972, an underground pipeline containing diethyl ether was broken during excavation near the west wall of the packaging room. Over the next several years, diethyl ether contamination was identified in downgradient residential wells southwest of the plant, approximately 0.5 mile away. U.S. Aviex installed six monitoring wells on the site beginning in 1972 and also provided alternate water supplies to homes with contaminated wells. In November 1978, a fire occurred on the site, and the large volumes of water used to extinguish the fire flushed unknown amounts of chemicals contained in barrels and tanks into the soil. Following the fire, chlorinated hydrocarbons were detected in domestic wells. Based on
(See Attached Sheet)

17. Document Analysis a. Descriptors
Record of Decision
U.S. Aviex, MI
First Remedial Action - Final
Contaminated Media: gw, soil
Key Contaminants: VOCs (benzene, TCA, TCE, toluene, xylenes)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement

19. Security Class (This Report)
None

21. No. of Pages
60

20. Security Class (This Page)
None

22. Price

(See ANSI-Z39.18) See Instructions on Reverse OPTIONAL FORM 272 (4-77)
(Formerly NTIS-35)
Department of Commerce

EPA/ROD/R05-88/073
U.S. Aviex, MI
rst Remedial Action - Final

16. ABSTRACT (continued)

data developed during a ground water investigation in 1982, a purge and treatment system using air stripping and discharge to surface water was designed and installed to contain the contamination. Contaminated ground water, however, is currently flowing offsite to the southwest into residential areas. The primary contaminants of concern affecting soil and ground water are VOCs including benzene, PCE, TCA, TCE, toluene, and xylenes.

The selected remedial action for this site includes: soil flushing of approximately 11,500 yd^3 of contaminated onsite soil; and collection of onsite and offsite ground water and fluids from the soil flushing process with treatment onsite by air stripping, and discharge to surface water. The estimated present worth cost for this remedial action in $3,024,000.

RECORD OF DECISION

SELECTED REMEDIAL ALTERNATIVE

Site Name and Location

U.S. Aviex
Niles, Michigan

Statement of Basis and Purpose

This decision document presents the selected remedial action for the U.S. Aviex Site in Niles, Michigan, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. (9601 et seq., (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Contingency Plan (40 CFR Part 300).

This decision is based on the administrative record for the U.S. Aviex Site. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action is based.

The State of Michigan has concurred on the selected remedy. A letter of concurrence is attached.

Description of the Selected Remedy

The selected remedy treats the on-site soil contaminated with volatile organic compounds (VOCs) by flushing. Groundwater, both on-site and off-site, contaminated by VOCs and fluids from the soil flushing alternative are collected and treated on-site by air stripping. A public water supply has been provided to the affected area under a separate action.

Declaration

The selected remedy satisfies the requirements of Section 121(a) of CERCLA as amended by SARA. The selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate to this remedial action and is cost-effective. This remedy satisfies the statutory preference for remedies

that employ treatment, that reduce toxicity, mobility or volume as a principal element and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The soil flushing alternative will be reviewed after five years of operation to ensure that human health and the environment are being protected by the remedial action.

Sept 7, 1988
Date

Valdas V. Adamkus
Regional Administrator

SUMMARY of REMEDIAL ALTERNATIVE SELECTION

U.S. AVIEX SITE
NILES, MICHIGAN

August 9, 1988

SUMMARY of REMEDIAL ALTERNATIVE SELECTION

U.S. AVIEX SITE
NILES, MICHIGAN

August 9, 1988

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SUMMARY of REMEDIAL ALTERNATIVE SELECTION

U.S. AVIEX SITE
Niles, Michigan

I. Site Location and Description

The U.S. Aviex Site is located at 1056 Huntly Road, City of Niles, Howard Township, Cass County, Michigan in a residential neighborhood made up of essentially single family homes. The nearest homes are within 100 feet south, east and north of the approximately six acre property. Minor agricultural and horticultural activities take place in the general vicinity of the site. There are three schools approximately 2.0 miles west of the U.S. Aviex site. Two schools are located about 1.5 miles northwest of the site. There are no storm or sanitary sewers nearby. Surface runoff from the U.S. Aviex site and nearby areas flows toward the Bame-Huntly drain and subsequently into Brandywine Creek, which begins about 0.5 mile east of the site. Brandywine Creek flows into the St. Joseph River in Niles. The St. Joseph River flows into Lake Michigan at St. Joseph, Michigan. See Figure 1 for a map of the U.S. Aviex plant site.

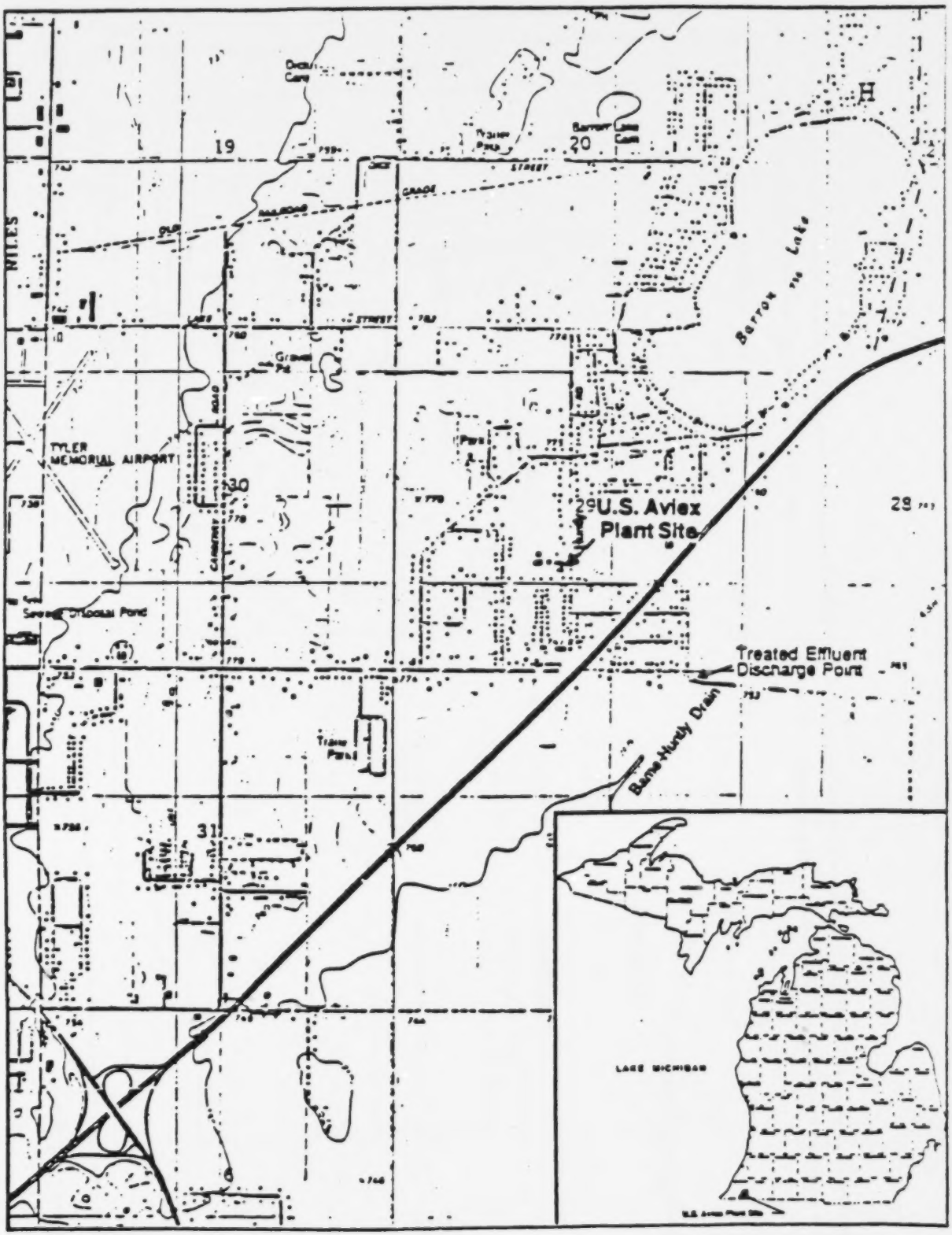
Baron Lake, a seepage lake with no surface inlets or outlets, is about 0.5 miles northeast of the site. The lake has a surface area of 199 acres and a maximum depth of 28 feet. There is a small wetlands west of the lake.

Site topography is generally level, with occasional low rises and gentle depressions. Very generally, the surface elevation rises 15-18 feet per mile from east to west in the vicinity of the site.

The site is located in an area of glacial deposits. Two broad types of deposits occur: glacial outwash and ice contact outwash. Typically these deposits are stratified and exhibit varying degrees of sorting between individual units, with considerable lateral variation. The upper unit of sand and gravel contains discontinuous clay layers and lenses; within this unit the vadose zone is 15 to 45 feet thick.

The water table aquifer is defined by a discontinuous sandy clay layer. The saturated thickness of the aquifer is 70 to 90 feet near the site, increasing to 100 feet in the western portion of the study area. Groundwater flow is southwest to west from the site becoming westerly approximately 0.5 miles downgradient. Transmissivity in the area is between 225,000 gal/day/ft and 31,000 gal/day/ft with a flow velocity of approximately 0.5 ft/day. Limited data indicates the presence of an artesian aquifer below the sandy clay layer with a flow pattern similar to the upper aquifer. The replacement residential wells are placed in this aquifer.

While the plant is no longer in operation, some buildings on the site are used for storage of non-production related materials. The original structures are shown in Figure 2. The structures presently in place



Adapted from EDI (1987b)

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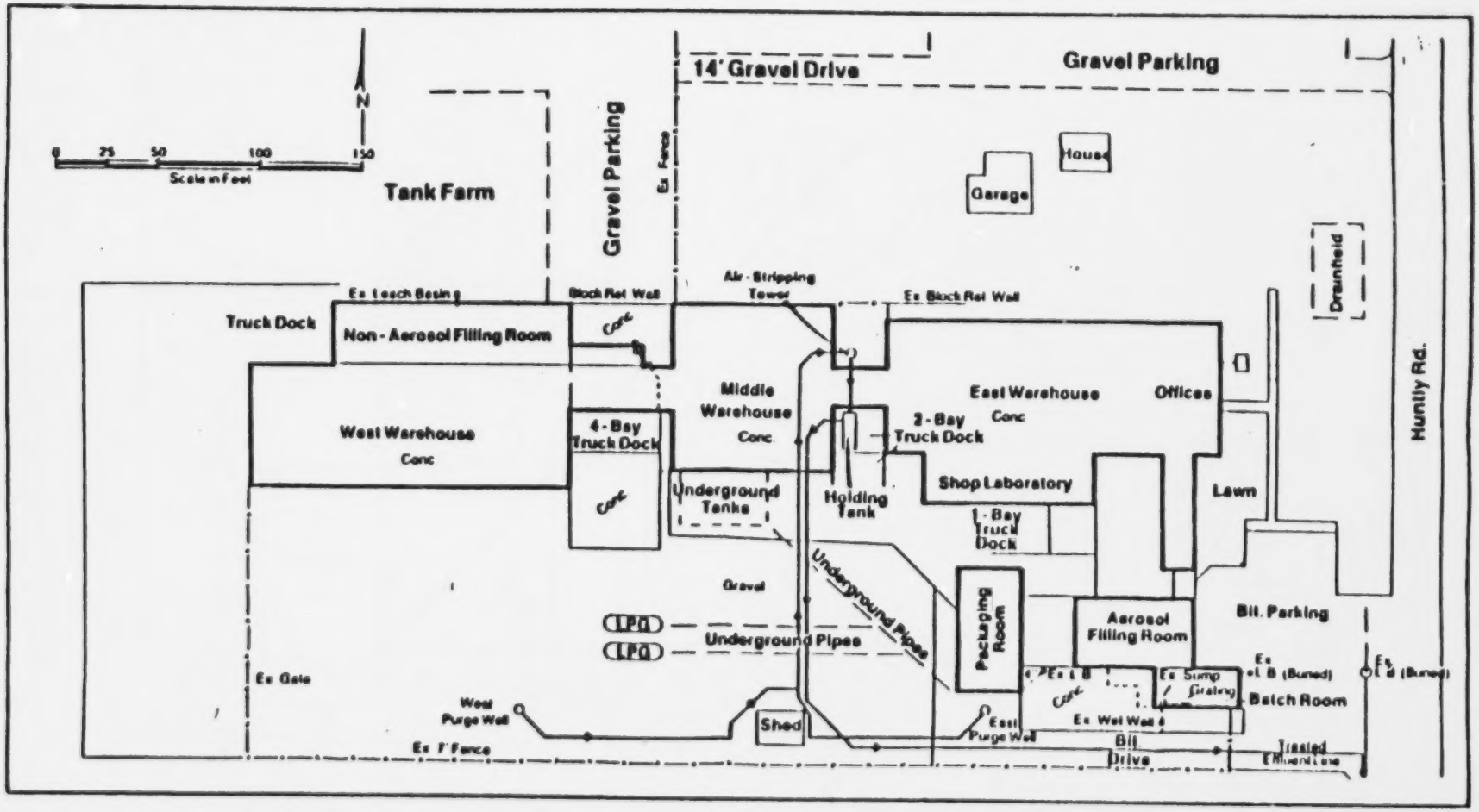
FIGURE 1 LOCATION OF THE U.S. AVIEX PLANT SITE



Adapted from EDI (1987b)

FIGURE 2 DETAIL OF U.S. AVIEX PLANT SITE

include the west warehouse, the concrete slabs from the middle and east warehouses, the offices, batch room, aerosol filling room, packaging room, truck docks, and the concrete, bituminous, lawn, and most of the gravel surfaces. The tank farm and part of the gravel parking area now consist of uneven ground and a bermed impoundment used for temporary storage of non-hazardous groundwater produced during an aquifer test performed on the site.

II. Site Background

A. Site History and Enforcement Activity

U.S. Aviex produced non-lubricating automotive fluids at the Huntly Road Plant from the early 1960s until late 1978. Activities at the plant included the repackaging of bulk products and the formulation of new products from bulk ingredients.

Sometime during the operation of the plant in the 1960s or 1970s, chlorinated hydrocarbons, including Trichloroethane (TCA), were apparently released into the vadose zone beneath the bituminous pavement south of the process rooms. These soils still contain significant quantities of TCA, Trichloroethylene (TCE), Perchloroethylene (PCE) and dichloro-compounds.

In July 1972, an underground pipeline containing diethyl ether was broken during excavation on the southeast side of the plant site near the west wall of the packaging room. Within a few months, diethyl ether (DEE) was detected in nearby residential wells on Lilac Street. Over the next several years, diethyl ether contamination was identified in downgradient residential wells southwest of the plant as far as Blanchard Street and Almaugus Drive, approximately one half mile away. Under an agreement with the Michigan Department of Public Health (MDPH), U.S. Aviex installed six monitoring wells on the site beginning in 1972 and also began supplying bottled water to homes with contaminated wells. In addition, U.S. Aviex installed new wells in a lower, uncontaminated aquifer for selected residences.

On November 28, 1978 a fire occurred on the site. The large volumes of water used to extinguish the fire washed unknown amounts of chemicals, released from barrels and tanks in the process buildings, onto unpaved areas. Following the fire, chlorinated hydrocarbons were detected in domestic wells as far west as Bame Street.

Early in 1982, the State of Michigan initiated legal action against U.S. Aviex and reached an agreement for a groundwater investigation of the site. On the basis of data developed during this investigation, an on-site groundwater purge and treatment system was designed and installed to contain the contamination outlined in the groundwater investigation. The system pumps up to a combined 200 gal/min through two purge wells from the contaminated upper portion of the aquifer. The water is then treated by air stripping and discharged to the surface water in compliance with a NPDES permit issued by the State of Michigan.

The U.S. Environmental Protection Agency (USEPA) initially became involved in the U.S. Aviex Site in 1984 as a result of its being placed on the Superfund National Priorities List. In 1985, U.S. Aviex agreed to fund a Remedial Investigation/ Feasibility Study (RI/FS) under an Administrative Order on Consent. The goal of the RI/FS was to determine the nature and extent of the threat to the public health or welfare or the environment caused by contamination from the U.S. Aviex plant site and to evaluate alternatives to establish the appropriate remedial actions to prevent or mitigate the migration or release of contamination from the site.

In 1986, U.S. Aviex filed Chapter 11 bankruptcy with the Bankruptcy Court for the Eastern District of Michigan. Funds had been previously set aside by U.S. Aviex to pay for the RI/FS so that the bankruptcy action did not stop the ongoing RI/FS at the site. Over the past two years, the federal government has been actively negotiating with U.S. Aviex and its creditors to reach an agreement to be approved and filed with the Bankruptcy Court, allowing for reimbursement of USEPA's costs of overseeing the RI/FS and some allowance for the anticipated clean-up costs.

Pursuant to Section 121 of SARA, a responsible party is ordinarily afforded the opportunity to negotiate an agreement with USEPA regarding the design and implementation of the selected remedial action. Due to the bankruptcy status of U.S. Aviex, however, the USEPA determined that negotiations for the funding would prove futile since the company does not possess available funds to pay for the clean-up.

Also, in 1985, under Michigan Act 307, the State of Michigan took steps to provide a public water supply and distribution system to the affected area. The system distributes water from the City of Niles public water supply to an estimated 220 homes in the area. The system is now complete and area residences have been connected to it.

B. Current Site Status

Chemicals originating in the soil at the U.S. Aviex plant site have contaminated groundwater beneath the site, formed a plume with the groundwater in the upper aquifer and are flowing off-site in a southwesterly direction. This plume is bounded on the north by a line from the site northwest to near the intersection of Janellen and Carberry Road, on the southeast by an irregular line extending from the site in a southwestern direction, and on the west by Carberry Road. The compounds within the plume have been identified as chlorinated hydrocarbons, diethyl ether and other volatile organic compounds in concentrations in the range of 0.001 mg/L to 5.6 mg/L.

Chemicals in the plume, if unabated, will continue to flow southwest down the hydraulic gradient into farther reaches of the neighborhood. The estimated speed of groundwater movement down the centerline of the plume in the study area is approximately 0.5 feet per day. Table 1 shows concentrations of the indicator compounds at three down-gradient exposure

points as determined by modeling.

Significant quantities of chlorinated hydrocarbons remain in the vadose zone beneath the entrance driveway to a depth of twenty feet near the southeast process buildings. There are about 10,000 cubic yards of contaminated soils in this area and about 1,500 cubic yards of contaminated soil in the truck dock near the west warehouse. Concentrations of volatile organics in these soils range from 0.01 mg/kg to 13.0 mg/kg.

In addition, a source of DEE may remain on the site in the north central area east of the former tank farm (see Figure 2). Additional investigation during the Remedial Design (RD) stage will be necessary to quantify this source and further define the on-site and off-site contamination of the soil and groundwater.

Operation of the purge wells and stripping tower on the site continues as provided for in the 1982 agreement between the State of Michigan and U.S. Aviex. The locations and spheres of influence of the purge wells during typical operation in September 1986 is shown in Figure 3. Containment is essentially complete for the most highly contaminated zone beneath the southeast entrance driveway area as this zone of contamination is within the sphere of influence of the purge wells. However, containment of the contaminants at the west boundary of the property is not complete because the extent of contamination west of the property boundary extends beyond the sphere of influence.

The RI identified twenty-five (25) volatile and semi-volatile organic chemical compounds in the on-site subsurface soils or the on-site and/or off-site groundwater. Table 2 summarizes these contaminants in each medium.

Of these twenty-five (25) volatile and semi-volatile organic chemical compounds, ten (10) were selected as indicator compounds to meet the objectives of the RI. Each indicator compound was selected because it meets one or more of the following criteria:

* It is a known or suspected carcinogen.
* It is a compound for which the USEPA has established drinking water Maximum Concentration Levels Goals (MCLGs) or proposed Maximum Concentration Levels (MCLs) or proposed MCLGs.
* It has a Safe Drinking Water Act Water Quality Criteria value (for drinking water only, no risk consumption).
* It is a compound identified at more than one sample location.
* It is a compound which occurs in extremely high concentrations.

The indicator chemical compounds selected for detailed study are:

Trans-1,2-dichloroethylene (Trans-1,2-DCE)
Benzene
1,2-Dichloroethane (1,2-DCA)
1,1-Dichloroethylene (1,1-DCE)
1,1,1-Trichloroethane (1,1,1-TCA)
Trichloroethylene (TCE)
Trichlorofluoromethane (TCFM)
Dichlorofluoromethane (DCFM)
Diethyl ether (DEE)
Perchloroethylene (PCE)

C. Public Health and Environmental Impact

No land uses other than the ones currently existing at exposure points are assumed. The U.S. Aviex plant is inactive but manufacturing facilities remain on-site and are presently used for storage only. There is no indication that anyone has been present on the site for an entire year. The land surrounding the site is a developed residential area and is likely to remain as such.

Potential exposure pathways based on estimates of exposure point concentrations in on-site and off-site ground water, in on-site air, and in on-site soils are ranked in approximate order of importance:

* Ingestion and associated contact with contaminated groundwater
* Direct contact with on-site soils
* Inhalation of airborne contaminants from soil volatilization and stack gas
* Inhalation of volatiles from ground water
* Ingestion of and contact with surface water
* Ingestion of contaminated fish and crops

In the absence of rigorous quantitative risk assessments, risk is assessed in two ways in accordance with the guidelines contained in the Superfund Public Health Evaluation Manual (USEPA 1986). First, the exposure point concentrations in various media are compared to the Applicable or Relevant and Appropriate Requirements (ARARs). The resultant ratio (exposure level/acceptable level) is not a quantitative measure of the incidence or severity of effects, but a numerical indicator of the transition between acceptable and unacceptable exposure levels. Any ratio greater than 1.0 indicates an unacceptable exposure level.

Second, chronic and subchronic chemical intakes are calculated from exposure point concentrations and standard human intake factors. Non-carcinogenic risks are assessed by calculating the ratio of human intake to the route specific Acceptable Intake for Subchronic Exposure (AIS) and the Acceptable Intake for Chronic Exposure (AIC) values and the ratio is summed to provide a total hazard index for that exposure route. The assumption that the adverse effect is proportional to this sum is consistent with USEPA's risk assessment guidelines for chemical mixtures.

TABLE I MODELED GROUND-WATER CONCENTRATIONS AT THREE EXPOSURE POINTS

Indicator Chemical	Almaugus St. (0.33 miles) Best Estimate,(a) mg/L	Upper Bound,(b) mg/L	Duration of Pulse,(c) years	Carberry Rd. (1 mile) Best Estimate, mg/L	Upper Bound, mg/L	Duration of Pulse, years	Municipal Wells (2 miles) Best Estimate, mg/L	Upper Bound, mg/L	Duration of Pulse, years
Model 1: Instantaneous Release(d)									
Benzene(e)	0.00052	0.001	2-	4.70×10^{-5}	0.00013	15-	2.60×10^{-8}	3.50×10^{-7}	55-
1,1 dichloroethane	0.09	0.236	7-	0.00094	0.011	44-			
1,2-Dichloroethane	0.113	0.674	4-57	0.036	0.12	25-	3.50×10^{-6}	-Not Arrived- 0.00011	65-
1,1-Dichloroethylene	0.012	0.038	10-	4.7×10^{-5}	0.00068	55-		-Not Arrived-	
Ethyl ether	1.07	4.210	4-	0.168	0.733	28-		-Not Arrived-	
Tetrachloroethylene(e)	0.004	0.009	2-	0.00037	0.0011	15-	2.10×10^{-7}	2.8×10^{-6}	55-
1,1,1-Trichloroethane	0.309	0.680	2-	0.028	0.082	15-	1.60×10^{-5}	0.00021	55-
Trichloroethylene(e)	0.013	0.029	2-	0.0012	0.004	15-	6.80×10^{-7}	9.0×10^{-6}	55-
Trichlorofluoromethane(e)	0.089	0.195	2-	0.008	0.024	15-	4.50×10^{-6}	6.0×10^{-5}	55-
Model 2: Continuous Release									
Benzene(e)	0.004	0.007	2-	0.00042	0.002	17-	9.38×10^{-8}	1.44×10^{-6}	53-
1,1-Dichloroethane	1.46	2.95	8-	0.00553	0.078	43-			
1,2-Dichloroethane	2.58	3.5	5-	0.803	3.31	25-	1.48×10^{-5}	-Not Arrived- 0.00051	63-
1,1-Dichloroethylene	0.247	0.497	11-	0.00023	0.0043	53-		-Not Arrived-	
Ethyl ether	6.41	10	5-	0.563	4.33	29-		-Not Arrived-	
Tetrachloroethylene(e)	0.039	0.064	2-	0.00369	0.018	17-	8.20×10^{-7}	1.26×10^{-5}	53-
1,1,1-Trichloroethane	2.76	4.55	2-	0.26	1.25	17-	5.86×10^{-5}	0.0009	53-
Trichloroethylene(e)	0.121	0.2	2-	0.011	0.055	17-	2.58×10^{-6}	3.97×10^{-5}	53-
Trichlorofluoromethane(e)	0.773	1.27	2-	0.073	0.35	17-	1.64×10^{-5}	0.00025	53-

(a) Seventy-year mean.
(b) Maximum concentration in 70 years.
(c) The date of the start and end of the arrival concentrations $>10^{-5}$ mg/L at an exposure point. If no second number is reported, pulse continues past 70 years.
(d) Compounds released during spills, but not after purge wells operate.
(e) Calculated using same plume transport properties as 1,1,1-trichloroethane.

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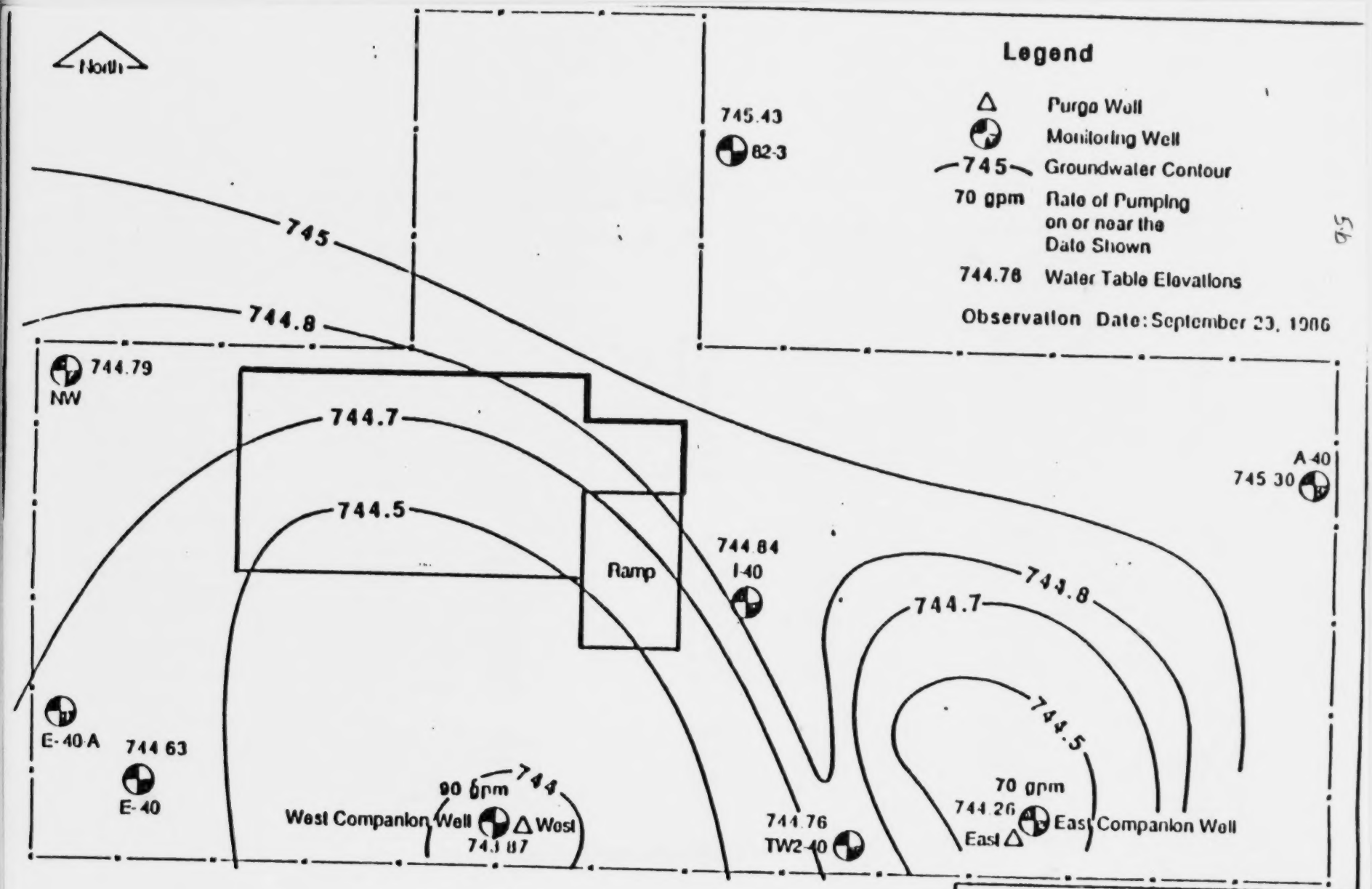

Figure 3

Purge Well Capture Zone

U.S. Avlex

TABLE 2. SUMMARY OF ANALYTICAL RESULTS FOR CHEMICAL COMPOUNDS

Chemical Compounds	On-Site Wells			Off-Site Wells			Soil		
	Range (mg/L)	Mean (mg/L)	N_1/N_2 (1)	Range (mg/L)	Mean (mg/L)	N_1/N_2	Range (mg/kg) (2)	Mean (mg/kg)	N_1/N_2
Acetone	0-0.190	0.011	2/20	0-0.33	1.9×10^{-4}	1/171	-	-	-
Benzene	0-0.029	0.003	9/32	0-0.005	3.9×10^{-5}	3/178	-	-	-
Carbon tetrachloride	ND	-	0/22	ND	-	0/178	0-1.230	0.041	1/30
Chloroethane	0-0.050	0.004	3/22	0-0.013	7.3×10^{-5}	1/178	-	-	-
Chloroform	0-0.001	4.5×10^{-5}	1/22	ND	-	0/178	-	-	-
Methyl cyclohexane	0-0.011	0.003	1/4	-	-	0/0	-	-	-
Dichlorodifluoromethane	0-1.000	0.143	2/7	0-0.003	5.0×10^{-4}	1/5	-	-	-
1,1-Dichloroethane	0-3.100	0.366	18/32	0-1.700	0.025	12/178	0-0.120	0.012	5/29
1,2-Dichloroethane	0-1.600	0.089	7/32	0-1.700	0.024	9/178	-	-	-
1,1-Dichloroethylene	0-5.200	0.278	10/32	0-0.330	0.004	4/178	0-0.045	0.005	5/29
Trans-1,2-dichloroethylene	0-0.570	0.059	11/32	0-0.110	1.4×10^{-3}	4/178	-	-	-
Dichlorofluoromethane	-	-	0	0-0.070	0.019	2/4	-	-	-
Dimethyl disulfide	0-0.003	0.001	1/4	-	-	0/0	-	-	-
Ethyl benzene	0-1.900	0.146	7.29	0-0.090	0.001	6/171	0-0.170	0.008	5/26
Ethyl ether	0-5.700	0.661	15/28	0-4.800	0.036	8/158	-	-	-
Isopropanol	ND	-	0/20	ND	-	0/178	-	-	-
Methylene chloride	0-0.002	9.1×10^{-5}	1/22	0-0.004	3.4×10^{-5}	2/178	-	-	-
Tetrachloroethylene	0-31.00	1.042	11/32	0-0.040	4.1×10^{-4}	4/178	0-10.200	0.761	10/42
Toluene	0-1.600	0.073	1/22	0-0.004	2.8×10^{-5}	2/178	0-0.005	1.7×10^{-4}	1/29
1,1,1-Trichloroethane	0-200.00	15.026	13/32	0-3.00	0.026	18/178	0-23.800	1.631	11/41
Trichloroethylene	0-0.880	0.135	12/29	0-0.130	0-0.001	4/178	0-1.650	0.095	6/31
Trichlorofluoromethane	0-27.000	1.756	12/32	0-0.860	0-0.009	4/168	0-0.160	0.014	7/29
2,2,4-Trimethyl pentane	0-0.005	0.001	1/4	0-0.008	0-0.002	1/4	-	-	-
2,2,4-Trimethyl pentane	-	-	0	0-0.002	0-0.001	1/4	-	-	-
Xylene	0-1.600	0.080	1/20	0-0.010	1.1×10^{-4}	2/178	0-0.010	3.6×10^{-4}	1/28

(1) N_1 = number of samples in which contaminant was detected; N_2 = number of samples analyzed.
(2) -, Compound not analyzed for.
(3) ND = Not detected.

Three of the exposure routes can be quantified. These routes are (1) possible ingestion of contaminated groundwater, (2) direct contact with contaminated on-site soils, and (3) inhalation of volatile emissions from site soils and stack gases.

1. Ingestion Route for potential ground-water and surface-water exposure via drinking water: The most appropriate comparison values are the MCLs of the Safe Drinking Water Act. Since these Federal drinking water standards and criteria are based on lifetime exposures, it is appropriate to use a ratio of long-term water concentration to the standard. Ratios were calculated in two ground-water transport models (instantaneous and continuous release) at 0.33, 1.0 and 2.0 miles from the site. On-site ratios are comparable to those calculated at 0.33 miles. Upper-bound estimates are calculated based on the maximum concentration levels experienced by the three locations in seventy (70) years.

Incremental cancer risks exceeding 10^{-6} indicate potential endangerment (USEPA 1986). Carcinogenic risks from ground-water ingestion exceed 10^{-6} at Almaugus Street (0.33 miles) and Carberry St. (1.0 miles), assuming either continuous or instantaneous release. In the worst case (continuous release) scenario, 1,2-DCA, 1,1-DCE, PCE, TCE and benzene all exceed the critical risk 0.33 miles from the site, and all but benzene and 1,1-DCE exceed this level 1.0 miles from the site. At the municipal wells 2.0 miles from the site, no contaminants of concern are at unacceptable levels now or at the end of the seventy-year period.

Hazard indices for individual indicator chemicals are summed and calculated to provide the total hazard index for the ground-water ingestion route. The noncarcinogenic chronic hazard index exceeds 1.0 only for the worst case scenario 0.33 miles from the site. Two indicator chemical compounds, 1,1-DCE and 1,1-DCA, contribute most heavily to the noncarcinogenic risk index. The chronic hazard index does not exceed 1.0 in seventy years at the more distant locations; the subchronic index does not exceed 1.0 at any location. These conclusions would be the same for resident children even though they have a daily intake about four times that of adults.

2. Soil Contact Route: There are no unacceptable risks for the soil contact route. Since there are no ARARs with which to compare soil contact risk, a comparison was made between the chronic acceptable oral intake values and calculated chemical intakes at the site to determine the potential endangerment to adults by direct contact with on-site soils.

Multiplying chronic daily intakes in mg/kg/day by the oral or inhalation cancer potency factor for the appropriate contaminant, yields the incremental lifetime cancer risk associated with ingestion or inhalation of that contaminant (USEPA 1986). Individual contaminant risks are summed so that the total risk due to carcinogen ingestion or inhalation for a particular route are obtained.

3. Inhalation Route: The potential endangerment from the inhalation

route is low. Since there are no ARARs with which to compare ambient air concentrations resulting from soil volatilization and stack gas emissions daily intakes are calculated using the USEPA's risk assessment guidelines for chemical mixtures (USEPA 1986). Neither subchronic or chronic total noncarcinogenic hazard indices approach 1.0 for either soil volatiles or stack gas. Soil volatiles contribute more contaminants to the air than stack gases but the numbers are very small. Adding the two totals to reflect exposure to both sources has little effect on the index as the totals never exceed 0.05 for best estimates or 0.6 for upper-bound estimates.

Cancer risks from purge well stack emissions are low (2.63×10^{-8}). The highest estimate of incremental cancer risk from inhalation of soil volatiles is 4.76×10^{-7}. Total upper-bound risk, calculated using the highest measured soil concentrations, is 4.72×10^{-6}. 1,1-DCE is the major contributor to this risk. The air inhalation route, therefore, presents a low risk of potential endangerment. The highest cancer risk, estimated from mean soil concentrations of cancer risk from dermal contact with soil, is 1.9×10^{-8}.

III. Community Relations History

Public participation requirements set out by Sections 113 and 117 of CERCLA, as amended, were satisfied during the remedial action process and include the following: Potentially affected persons and the public where notified of the remedial action through two notices published in the local Niles community newspaper; interested persons on the Agency's mailing list received direct mailings; information repositories for public review were established at the Howard Township Hall and the Niles Community Library; the U.S. Aviex Administrative Record was made available to the public and is housed at the Niles Community Library, and Fact Sheets were distributed at public meetings. Two public meetings were held on June 15 and July 12, 1988 to discuss the Proposed Plan and the RI/FS, and accept comments.

A twenty-one (21) day public comment period for the Proposed Plan commenced on June 6 and ended on June 26, 1988. As a result of public interest in the U.S. Aviex remedial action, the public comment period was extended through July 18, 1988. A Responsiveness Summary detailing the Agency's response to significant comments submitted during the comment period, is attached to the ROD.

IV. Scope of Response Action

At the U.S. Aviex site there is a potential public health hazard from exposure to contaminated groundwater. The public health risk results from the possibility of persons in the effected area consuming contaminated groundwater and the long-term potential impact on the City of Niles municipal water supply wells. The purpose of the overall remedial objectives are to provide:

* On-site control of the source of contamination by minimizing leachate production of contaminated groundwater under the site in

to off-site areas.

* Off-site management of plume migration. Purging and treating groundwater within the 10^{-6} and/or noncarcenogenic threshold value plume to meet Federal or State drinking water quality standards and criteria will reduce the potential for human exposure to contaminants and reduce the impact on groundwater resources by minimizing migration of off-site contaminants.

To evaluate the remedial action alternatives for the off-site control of groundwater, analytical modeling simulation of the aquifer along with the addition of hypothetical purge wells to capture the contaminant plumes, was done.

Permeability data, developed during the modeling of the aquifer in the RI, was reviewed and a representative value used, along with the typical aquifer thickness, to obtain a transmissivity (T) value of 90,000 gal/day. A storage factor(s) of 0.13, used in RI modeling, and an alternate value of 0.2 were employed along with the T value in an analytical well-field model, developed by EDI, which is based on Theis and Jacobs modified nonequilibrium equation. The relative position of the computer generated capture plumes was nearly the same under the alternative storage factor assumptions.

Other assumptions included in the model are a pumping time period of two weeks (T+14 days) and recharge due to precipitation at twelve inches per year. Several trial runs resulted in alternative scenarios for groundwater capture on-site and off-site using up to five wells, producing in the range of 60 to 180 gal/min.

The remainder of this section discusses the factors considered in the selection of purge well locations, the procedure used to estimate the initial treatment concentrations and the remediation goals for the groundwater and effluent.

A. Selection of Purge Well Locations

The purge wells were located in the areas best suited for evaluating the groundwater capture alternatives and to recover DEE from the semi-isolated shallow groundwater zone area of Purge well 82-3 (See Figure 4.)

Purge well 3A (See Figure 4) will be installed to operate as a supplemental well to the pair of purge wells currently on site. This well will effect continued cleanup of groundwater beneath the site, intercepting chemicals leaching from the vadose zone in the existing entrance driveway area, capturing contaminants at and beyond the southwest corner of the site. The total groundwater flow rate will be approximately 250 gal/min. The groundwater capture zone for this alternative is assumed to be just beyond the site boundaries.

Four purge wells are located in the contaminant plume of toxicological and risk-assigned chemicals up to and including

concentrations at the 10^{-6} level and corresponding toxicological threshold values. The position of the estimated area of groundwater capture and approximate well locations are shown in Figure 5. Purge well 1B, the existing east purge well, is designed to operate at 60 gal/min. and contain the source of contaminants in the entrance driveway area. Purge well 2B, to be located near the intersection of Bame Avenue and Lilac Street, is in the higher concentration zone of the dichlorinated volatile organic compounds (VOCs). The well is designed to operate at 120 gal/min. Purge well 3B is located a little beyond the downgradient limit of the 10^{-6} risk area on Blanchard Street and is intended to produce at 180 gal/min. Purge well 4B is located on the north/south leg of Blanchard Street in the higher concentration zone of contamination of the VOCs and is intended to operate at 120 gal/min.

The total pumpage from the four purge wells is 480 gal/min. When combined with the shallow ether-capture wells on site, the estimated total flow to treatment will be 500 gal/min.

Five purge wells are sited to capture primary groundwater contamination. The position of the estimated area of groundwater capture and approximate well locations are shown in Figure 6. Wells 1C and 2C correspond to Wells 1B and 2B, respectively, and will fulfill the same functions as in the 10^{-6} risk-related alternative. Well 3C is sited approximately 600 feet northwest of its 3B counterpart and off the center of the plume. Well 4C is sited approximately 600 feet northwest of the Yankee Street homes (2379 and 2383) that showed the 1,1,1-TCA. Well 5C is located approximately 350 feet north of Almagus Drive and Lilac Avenue to intercept the low levels of PCE.

Wells 3C and 4C have been shifted to the north of the plume center to effect a continuous groundwater capture zone with Well 5C and maintain an area of influence that extends a sufficient southward distance to capture all the primary plume.

B. Estimation of Initial Treatment Concentration

Treatment influent and effluent data from the existing operational purge and treat system were used to estimate initial concentrations under the groundwater capture alternatives. Concentrations insignificant for developing treatment alternatives were not considered and included very low levels of chlorinated organics and DEE.

The estimation procedure consisted of:

* Assigning concentrations, by compound, to each proposed purge well based on the local groundwater quality data collected in 1986.

* Weighing the combined influent concentrations to the proposed purge wells according to individual purge well flows.

* Reducing the weighted results by 50%.

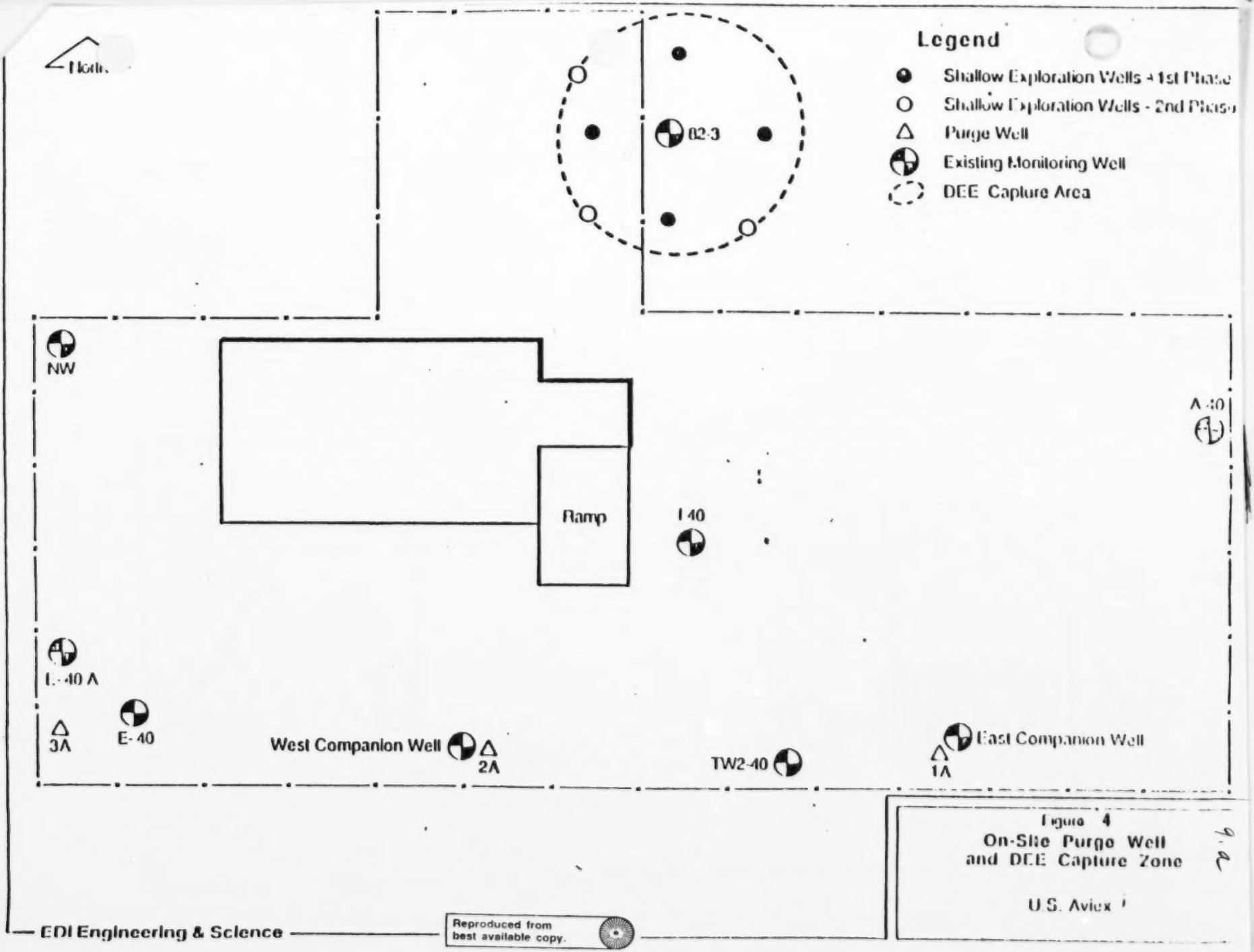

Figure 4
On-Site Purge Well
and DEE Capture Zone

U.S. Aviex

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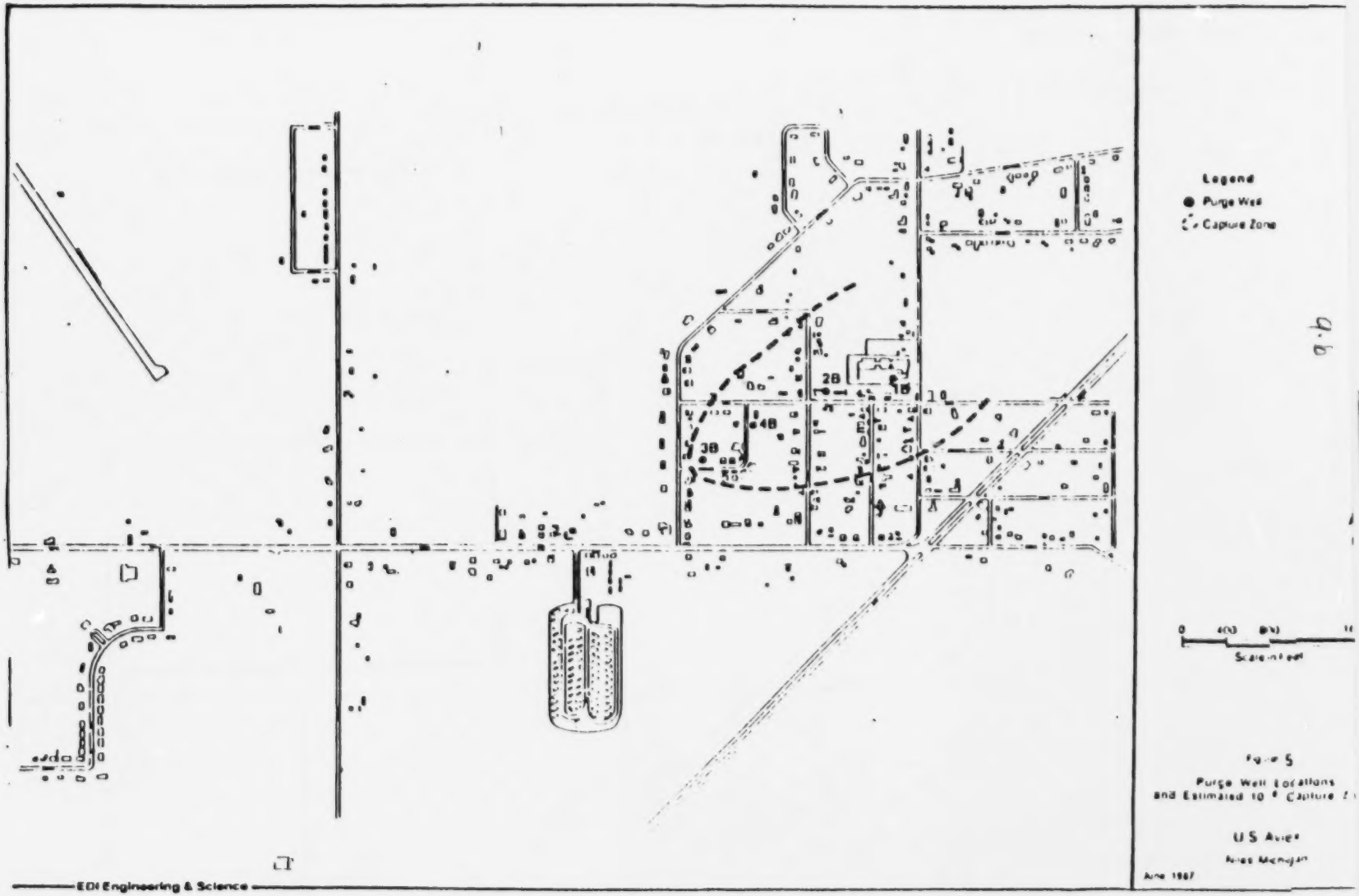
Legend
Purge Well
Capture Zone
2B
3B
4B
0
400
800
Scale in feet
Figure 5
Purge Well Locations
and Estimated 10 ft Capture Z
U S Avier
Ann Arbor
June 1987
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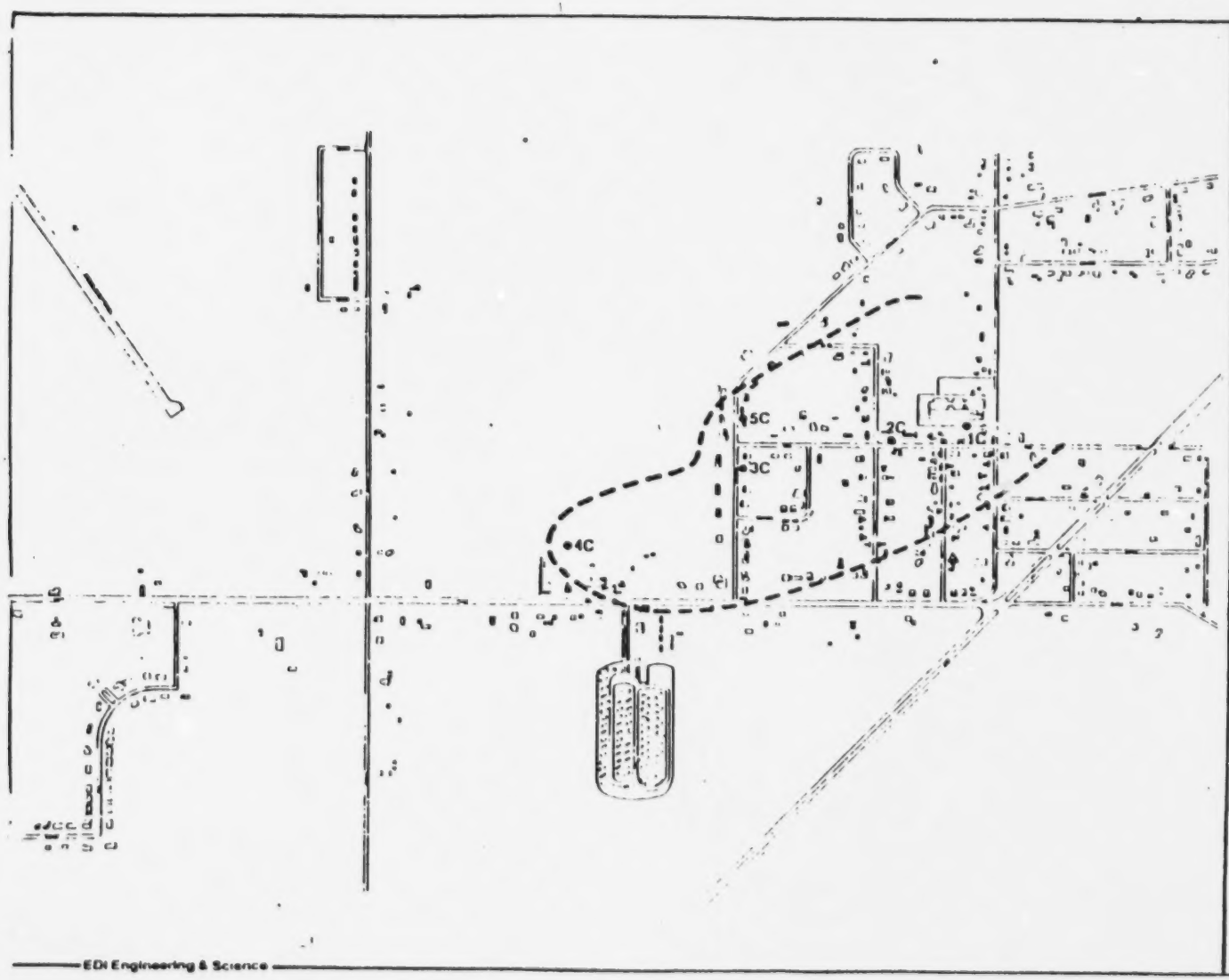

Figure 6

Purge Well Locations and Estimated Primary Plume Capture Zone

U S Forge

Ross Oregon

June 1987

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Table 3 includes the data involved in the compound concentration estimates.

C. Groundwater Remediation Goals and Minimum Treated Effluent Discharge Goals

The groundwater cleanup strategy for the U.S. Aviex site is to install and operate purge wells in the plume that will collect and treat on-site and off-site contaminated groundwater found within the U.S. Aviex related 10^{-6} risk plume and in the primary plume, out to its projected limits, (see Figure 7) to comply with existing drinking water standards or EPA or MDNR water quality criteria values for human health (see Figure 8). Table 4 lists the clean-up goals for the chemical compounds of concern.

TABLE 4

GROUNDWATER CLEAN-UP GOALS

Compound	Concentration (mg/l)	Risk level	Basis
Benzene	0.005	4×10^{-6}	MCL
Ethylbenzene	0.680	-	Proposed MCLG
Toluene	2.0	-	Proposed MCLG
Xylene	0.440	-	Proposed MCLG
Chloroform	0.002	1 x 10-6	Water Quality Criteria for Human Health
1,2-DCA	0.005	1×10^{-5}	MCL
1,1-DCE	0.007	1×10^{-4}	MCL
TCE	0.005	2×10^{-6}	MCL
PCE	0.00088	1×10^{-6}	Water Quality Criteria for Human Health
Trans-1,2-DCE	0.70	-	Proposed MCL
1,1,1-TCA	0.200	-	MCL
DEE	0.043	-	MDNR Rule 57-HLSC*
TCFM	32.0	-	MDNR Rule 57-HLSC*
DCFM	3.0	-	MDNR Rule 57-HLSC*

* Concentrations proposed but never adopted due to insufficient data.

The proposed groundwater cleanup alternatives(s) will be in operation until the water quality within the plume is remediated to a level that equals or exceed the individual compound concentrations listed in Table 4. In the process of achieving groundwater cleanup goals, the purged groundwater would be treated to meet minimum concentrations for the various chemicals of concern prior to discharge based on either NPDES permit limits or POTW industrial pretreatment standards. The minimum effluent goals for this site are presented in Table 5. City of Niles POTW pretreatment standards are shown in Table 6.

Purge Well Compound Concentration Estimation Data/Summary

Purge Well	Compound	Concentration (mg/l)	Data Source	Flows: A Wells in Alt B-1/B-2	Flows: B Wells in Alt C-1/C-2 10^{-6} Risk Plume	Flows: C Wells Alt C-1/C-2 Primary Plume	Remarks
1	1,1,1-TCA	0.8	Existing Purge Wells	100	60	60	Existing combined purge well influent (4/87) x 2 to estimate PW 1 value
	1,2-DCA	0.012	Existing Purge Wells				Existing combined purge well influent (4/87) x 2 to estimate PW 1 value
	1,1-DCA	0.04	Existing Purge Wells				Existing combined purge well influent (4/87) x 2 to estimate PW 1 value
	1,1-DCE	0.015	Existing Purge Wells				Existing combined purge well influent (4/87) x 2 to estimate PW 1 value
	TCFM	0.09	Existing Purge Wells				Existing combined purge well influent (4/87) x 2 to estimate PW 1 value
2(B,C)	DEE	5.6	86-3	-	120	120	86-3 well is the same as on-site monitoring well E-40A
	1,1,1-TCA	2.0	Fig. 21 (RI)				
	1,2-DCA	1.5	86-3				
	1,1-DCA	0.5	Fig. 22 (RI)				
	1,1-DCE	0.1	Fig. 24 (RI)				
	TCFM	0.09	86-2				
3B	1,1,1-TCA	0.1	Fig. 21 (RI)	-	180	-	
	1,2-DCA	0.5	Fig. 23 (RI)				
	DCFM	0.003	Fig. 25 (RI)				
3C	B-T-X (Benzene, toluene, xylene)	0.1	1044 Almagus	-	-	150	Well 3C's location is north of the main plume to effect a combined capture zone with Well 5C. Well 3C may intercept B-T-X based on pre-1986 house well testing by MDPH.
4B	DEE	1.0	Fig. 20 (RI)	-	120	-	
	1,1,1-TCA	0.5	Fig. 21 (RI)				
	1,2-DCA	2.0	Fig. 23 (RI)				
4C	1,1,1-TCA	0.01	Fig. 21 (RI)	-	-	150	
5C	PCE	0.04	Fig. 25 (RI)	-	-	120	

10.a

TABLE 3 (CONT'D)

Purge Well	Compound	Concentration (mg/l)	Data Source	Flows: A Wells In Alt B-1/B-2	Flows: B Wells In Alt C-1/C-2 10^{-6} Risk Plume	Flows: C Wells Alt C-1/C-2 Primary Plume	Remarks
3A	1,2-DCA	1.6	Table 1 (RI)	50	-	-	July 1986 monitoring results E-40, E-40A
	1,1-DCA	1.1	Table 1 (RI)				July 1986 monitoring results E-40, E-40A
	trans-1,2-DCE	0.2	Table 1 (RI)				July 1986 monitoring results E-40, E-40A
	Benzene	0.03	Table 1 (RI)				July 1986 monitoring results E-40, E-40A
Cluster at 82-3	DEE	5.7	Table 1 (RI)	20	20	20	July 1986 monitoring results 82-3
Existing On-site West Purge Well				100	-	-	
	Total Flows (gal./min.)			270	500	620	

	Total Concentrations (weighted, mg/l): A Wells B-1/B-2	B Wells C-1/C-2	C Wells C-1/C-2	... x 50%: A Wells B-1/B-2	B Wells C-1/C-2	C Wells C-1/C-2
DEE	0.42	1.8	1.3	0.21	0.9	0.65
1,1,1-TCA	0.3	0.61	0.47	0.15	0.31	0.24
1,2-DCA	0.3	1.02	0.29	0.15	0.51	0.15
1,1-DCA	0.22	0.13	0.10	0.11	0.065	0.05
1,1-DCE	0.006	0.026	0.023	0.003	0.013	0.012
TCFM	0.033	0.032	0.026	0.017	0.016	0.013
DCFM	-	0.001	-	-	0.0005	-
PCE	-	-	0.008	-	-	0.004
trans-1,2-DCE	0.037	-	-	0.018	-	-
B-T-X	-	-	0.024	-	-	0.012

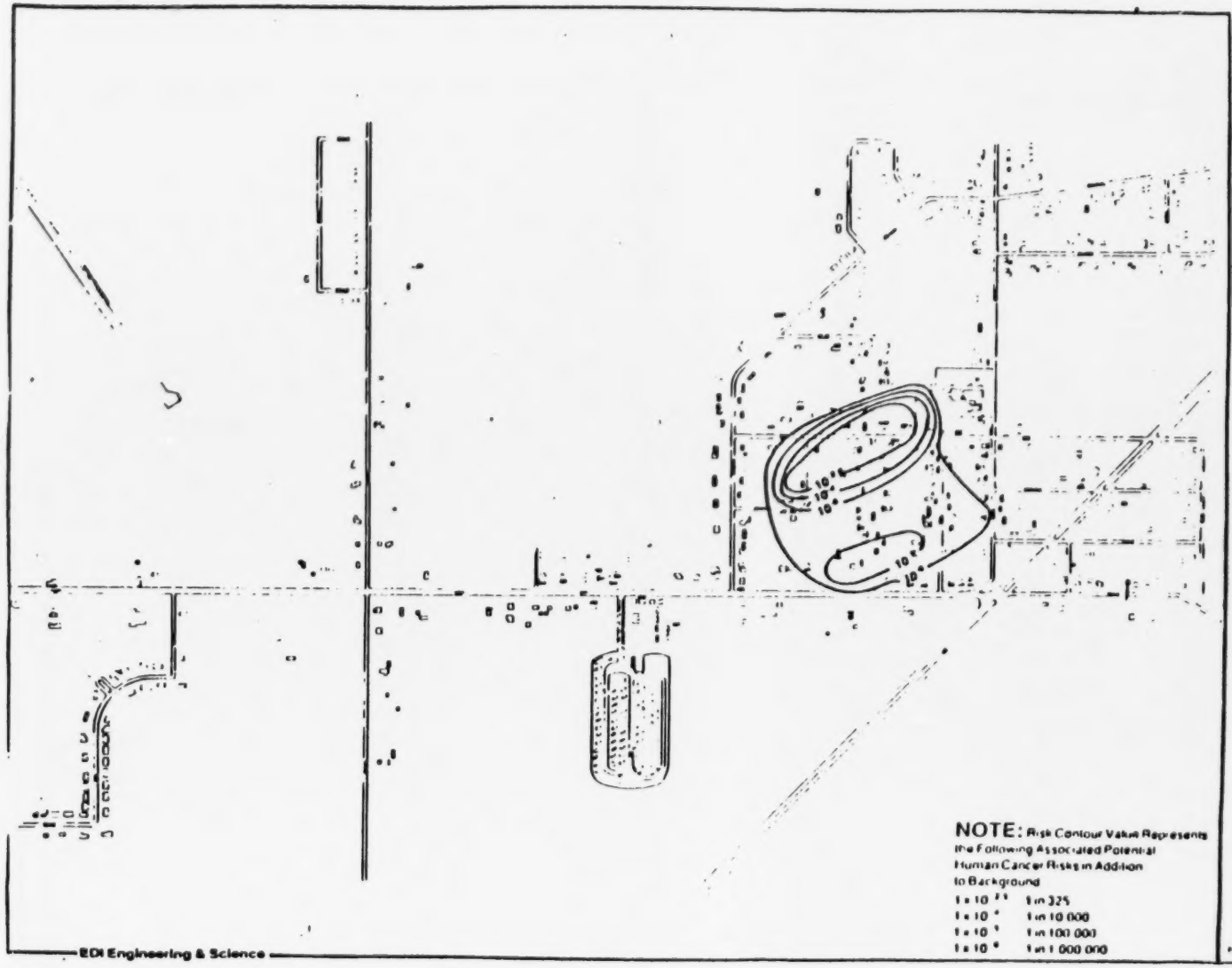
NOTE: Risk Contour Value Represents the Following Associated Potential Human Cancer Risks in Addition to Background
1 x 10⁻³ 1 in 325
1 x 10⁻⁴ 1 in 10 000
1 x 10⁻⁵ 1 in 100 000
1 x 10⁻⁶ 1 in 1 000 000
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Figure

Estimated Contours of Total Human Risk Associated with Maximum Concentrations of Carcinogenic Compounds Detected in Groundwater, 198

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November 1988

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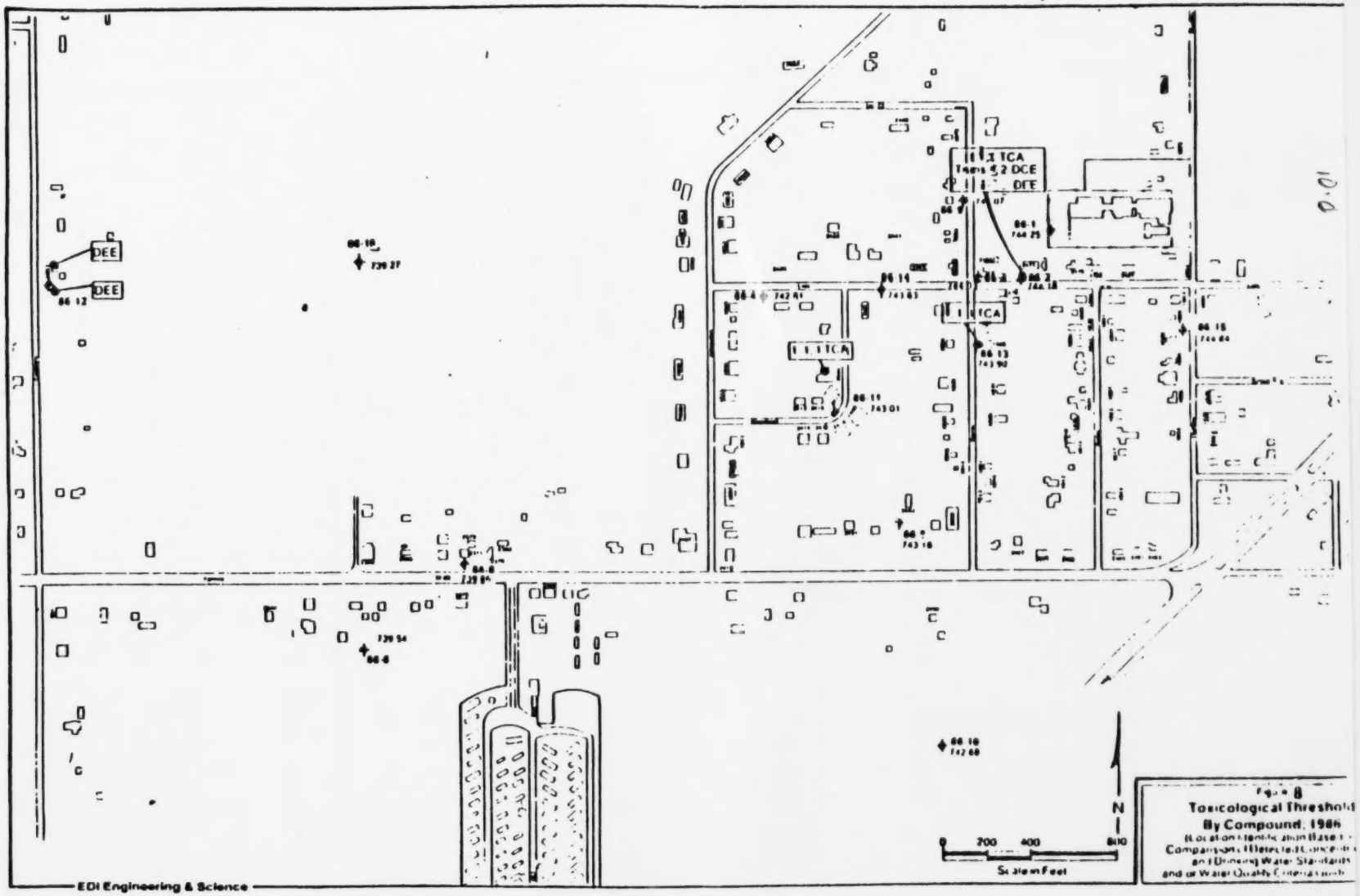

Figure 8
Toxicological Threshold
By Compound, 1986
(Location Isopleth Based
Comparison Effected Concentr
on Drinking Water Standards
and or Water Quality Criteria)

TABLE 5

MINIMUM EFFLUENT GOALS (surface water)

Compound	Concentration (mg/L)	Basis
Benzene	0.051	MDNR Rule 57 - ACV
Ethylbenzene	0.062	MDNR Rule 57 - ACV
Toluene	0.100	MDNR RULE 57 - ACV
Xylene	0.040	MDNR Rule 57 - ACV
Chloroform	0.043	MDNR Rule 57 - CRV
1,2-DCA	0.560	MDNR Rule 57 - CRV
1,1-DCE	0.003	MDNR Rule 57 - CRV
TCE	0.094	MDNR Rule 57 - ACV
PCE	0.020	MDNR Rule 57 - CRV
Trans-1,2-DCE	0.090	MDNR Rule 57 -TLSC
1,1,1-TCA	0.120	MDNR Rule 57 - ACV
DEE	0.275	Technology Based*
TCFM	0.020	Technology Based*
DCFM	0.020	Technology Based*

AVC - Aquatic Chronic Valve
CRV - Cancer Risk Value
TLSC - Terrestrial Life Cycle Safe Concentration *Based on Air Stripping

Diethyl ether (DEE) at 5-6 mg/L persists in a shallow, thin, saturated zone of ground water (5-15 feet thick) at depths ranging from 20 to 40 feet in the area of on-site monitoring well 82-3 (See Figure 4). This saturated zone is underlain with clay. The continued presence of the DEE is due to the poor hydraulic connection between the DEE zone and the part of the aquifer in which the existing purge wells are operating.

Four shallow exploration borings and wells are proposed, see Figure 3, to identify the limits of the DEE zone in the first phase of investigation. The drilling would use hollow-stem auger with split-spoon sampling and field screening of soils at five foot intervals. Two-inch galvanized steel casing with three foot stainless steel well points would be installed, the top of the screen three feet below the water table or with the well point in clay, which ever is more shallow.

These wells will be sampled and analyzed for volatile organics, including DEE, n-propanol, xylene and TCFM. Up to six selected soil samples will be analyzed for the same parameters, if needed to verify the presence of contaminants in the unsaturated zone. Based upon the results of the investigation, up to three additional borings and wells will be installed, sampled, and analyzed as above to establish the spatial limits of on-site DEE contamination.

When the extent of soil and groundwater contamination is determined,

TABLE 6

POLLUTANT DISCHARGE LIMITS

City of Niles

August 1985

		Limit
Arsenic[1]		1.1 mg/l
Cadmium		0.69 mg/l
Chromium (total)		2.77 mg/l
Copper		3.38 mg/l
Lead		0.69 mg/l
Nickel		3.98 mg/l
Silver		0.43 mg/l
Zinc		2.61 mg/l
Cyanide		1.20 mg/l
BOD(5)	Surcharge above 300 mg/l	Upper limit 1,000 mg/l
Suspended Solids	Surcharge above 350 mg/l	Upper limit 1,000 mg/l
Phosphorus	Surcharge above 20 mg/l	Upper limit 100 mg/l
Ammonia	Surcharge above 20 mg/l	Upper limit 100 mg/l
COD		450 mg/l
Chlorine Demand		16.0 mg/l
Fats, Oils, Grease		100 mg/l
pH (must be)		6.0 to 9.5
Heat: Limited to 104°F at plant influent		[1]No discharge above 150°F
Halogenated Hydrocarbons*		
Chloroform		1.9 ug/l
Trichloroethylene		27.0 ug/l
Tetrachloroethylene		8.0 ug/l
1,2-Dichloroethane		9.4 ug/l
Carbon Tetrachloride		4.0 ug/l
BTX		13.0 ug/l
Aromatics*		
Benzene		6.6 ug/l
Chlorobenzene		20.0 ug/l
Dichlorobenzene		400.0 ug/l
5-Tetrachlorobenzene		38.0 ug/l
Pentachlorobenzene		74.0 ug/l
Hexachlorobenzene		7.2 ug/l
Aromatics*		
Benzene		6.6 ug/l
Chlorobenzene		20.0 ug/l
Dichlorobenzene		400.0 ug/l
5-Tetrachlorobenzene		38.0 ug/l
Pentachlorobenzene		74.0 ug/l
Hexachlorobenzene		7.2 ug/l
Phenols*		0.3 mg/l
Phenol		0.1 ug/l
2-Chlorophenol		0.1 ug/l
4-Chlorophenol		0.3 ug/l
2,4-Dichlorophenol		0.1 ug/l
2,4,6-Trichlorophenol		0.04 ug/l
2,3-Dichlorophenol		940 ug/l
Pthalate Esters*		

* Data obtained from U.S. EPA Treatability Manual, Volume 1, EPA-600/2-82-001a, September 1981.

to four 4-inch galvanized steel wells with 4-inch diameter stainless steel screen three feet long will be installed to dewater. Actual field information may suggest more effective groundwater removal could be accomplished with one or two sump wells.

Depending upon the amount of DEE and its concentration in soils above the water table, it may be desirable to add an independent recovery process to purge the aerated soils of volatiles. Except for a zone of sand with clay binder at 11 to 13.5 feet, the profile above the clay at 23.5 feet is logged as granular with fine or fine to medium sand and occasional gravel. Either an enhanced volatilization or soil flushing method could be used.

V. Screening of Alternatives

From the remedial action technologies evaluated, potential alternatives were identified that meet the remedial action objectives. These potentially applicable alternatives were screened to determine those which should be evaluated in detail. The following screening criteria were used to eliminate those technologies not applicable to the U.S. Aviex site:

1. Technology not practical for this site because of site characteristics.

2. Technology uses unproven technology.

3. Technology not consistent with the clean-up criteria established by the Superfund Amendments and Reauthorization Act (SARA) of 1986.

   "While the basic framework (of the remedial process) remains intact, SARA does add some new features and emphasis. The most significant emphasis of SARA is on risk reduction through destruction or detoxification of hazardous waste by employing treatment technologies which reduce toxicity, mobility or volume rather than protection achieved through prevention of exposure. SARA calls for the Agency to prefer remedies that use treatment to permanently and significantly reduce the toxicity, mobility, or volume of wastes over remedies that do not use such treatment. In addition, SARA requires that the Agency select a remedy that utilizes permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable." (From a memorandum issued by J. Winston Porter, Assistant Administrator, EPA: Titled: Interim Guidance to Agency Regional Offices Discussing Issues Related to Selecting Superfund Site Remedies; dated Dec. 24, 1986.)

4. Requires excessively long periods of time to implement or to effectively clean up site in relation to remedial action objectives.

5. Excessive relative costs.

6. Environmental considerations.

If a particular remedial action alternative met one or more of the above criteria then it was considered not appropriate for the site. A summary of remedial alternative screening is presented in Table 7. The following alternatives were deemed not appropriate for use at the U.S. Aviex site.

On-Site Soils

No Action; No Treatment of On-site Soils

Not consistent with the clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, or provide a permanent solution. Also is not consistent with remedial action objectives established for this site.

Control leachate by removal of soils and off-site disposal in an Act 64 landfill.

Not consistent with the clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, reduce its volume, or provide a permanent solution in keeping with cradle-to-grave responsibilities.

On-Site Groundwater

No Action A: No Treatment of On-site Groundwater.

Not consistent with the clean-up criteria established by SARA of 1986: Does not destroy or detoxify the waste or reduce its mobility or volume. Also not consistent with the remedial action objectives established for this site.

No Action B: Continue with Existing Purge and Treatment System

Capture and treatment of on-site groundwater will continue to be needed but in a combined configuration with off-site purge wells that could result in elimination of an existing purge well.

Collection with On-site Purge Well and Disposal by On-site Deep-well Injection: Excessive relative cost (approximately $2,000,000 to permit and install only). Not consistent with clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, or reduce its volume and excessive time (up to two years) is required to obtain approval, if at all, due to permit requirements.

Collection with On-site Purge Well and Disposal by Off-site Deep-well Injection: Excessive relative cost (approximately $2,000,000 to permit and install only). Not consistent with clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste or reduce its volume, excessive time required to obtain approval, if at all, (up to two years) due to permit requirements. Capture and treatment of on-site groundwater will continue to be needed but in a combined configuration with off-site purge wells that could result in elimination of an existing purge well or

TABLE 7

SUMMARY OF REMEDIAL ALTERNATIVE SCREENING

Remedial Alternative	Site Conditions	Tech	SARA	Implementation Timeframe	Relative Cost	Environmental Consideration	Screen Decisi
On-Site Source Control-Soils							
No Action	-	-	Not Consistent Not Permanent Selection	-	-	Inconsistent with remedial action obj.	E
In-situ-Aeration	Amenable	Proven	Consistent	Acceptable	Acceptable	Good	R
In-situ-Flushing	Amenable	Proven	Consistent	Acceptable	Acceptable	Good	R
Capping	With Modif. Amenable	Proven	Not Consistent Not Permanent Sol.	Acceptable	High	Does not eliminate source	R
Removal/Off-Site Disposal							
- Aeration/641 Landfill	Amenable	Proven	Not Consistent	Moderate	High	Uses up Landfill Space, Release of VOC's	R
- Incineration/641 Landfill	Amenable	Proven	Not Fully Consistent	Moderate	High	Uses up Landfill Space	R
I.A.3.c Removal/Off-Site Landfill	Amenable	Proven	Not Consistent	Moderate	High	Uses up Landfill Space, Release VOC's	E
On-Site Source Control-Groundwater							
No Action A	-	-	Not Consistent Not Permanent	-	-	Inconsistent with Remedial Action Obj.	E
No Action B	Amenable	Proven	Consistent	Long-term	Acceptable	Need to Expand Existing System to Comply	E
On-Site Collection, Treatment with Off-Site Disposal	Amenable	Proven	Consistent	Long-term	POTW High Drain Acceptable	Good	R
On-Site Collection with Off-Site Treatment/ Disposal	Amenable	Proven	Consistent	Long-term	POTW High Drain Acceptable	May not meet POTW Standards	R
On-Site Collection, Disposal by On-Site Deep Well Injection	Available Underground Formation Questionable	Proven with Reservations	Not Consistent	Moderate-term	Excessive	Questionable	E
On-Site Collection, Disposal by Off-Site Deep Well Injection	Available Underground Formation Questionable	Proven with Reservations	Not Consistent	Moderate-term	Excessive	Questionable	E

Table 7 (Cont'd)

Remedial Alternative	Site Conditions	Tech	SARA	Implementation Timeframe	Relative Cost	Environmental Consideration	Screening Decision
Collect, Store, and Disposal Untreated by:							
Off-Site Deep Well Injection	Available Underground Formation Questionable	Proven with reservations	Not Consistent	Long-term	Excessive	Questionable	E
On-Site Deep Well Injection	Available Underground Formation Questionable	Proven with reservations	Not Consistent	Long-term	Excessive	Questionable	E
Collect, Temporary Storage, Discharge Untreated Groundwater to Surface Drain	Amenable	Proven, storage not required	Not consistent	Long-term	Acceptable	Would not meet NPDES	E
Collect, Temporary Storage, Discharge to Niles POTW	Amenable	Proven, storage not required	Consistent	Long-term	High	POTW may not accept	R
Collect, Transport Back to Site, Store, Treat/Disposal							
Air stripping with Dame-Huntly discharge	Amenable	Proven, storage not required	Consistent	Long-term	Acceptable	Good	R
Air stripping with Niles POTW discharge	Amenable	Proven, storage not required	Consistent	Long-term	High	POTW may not accept	R
Steam stripping with Dame-Huntly discharge	Amenable	Proven, storage not required	Consistent	Long-term	Acceptable	Good	R
Steam stripping with Niles POTW discharge	Amenable	Proven, storage not required	Consistent	Long-term	High	POTW may not accept	R
Carbon adsorption with Dame-Huntly discharge	Amenable	Proven, storage not required	Consistent	Long-term	Acceptable	Good	R
Carbon adsorption with Niles POTW discharge	Amenable	Proven, storage not required	Consistent	Long-term	High	POTW may not accept	R

Table 7 (Cont'd)

Remedial Alternative	Site Conditions	Tech	SARA	Implementation Timeframe	Relative Cost	Environmental Consideration	Screen Decision
Management Migration Groundwater (off-site/on-site)							
No Action	-	-	No permanent solution Not consistent	-	-	Inconsistent with Remedial Action Obj.	E
Monitor Only	Amenable	No Clean-up	Not a permanent solution, not consistent	Long-term	Acceptable	Inconsistent with remedial action obj.	E
Collect, store, transport to treat system via pipeline with off-site treat/disposal							
Air stripping with Bame-Huntly discharge	Amenable	Proven, but impractical; storage not required	Consistent	Long-term	Acceptable	Siting	E
Air stripping with Niles POTW discharge	Amenable	Proven, but impractical; storage not required	Consistent	Long-term	High	POTW may not accept	E
Steam stripping with Bame-Huntly discharge	Amenable	Proven, but impractical; storage not required	Consistent	Long-term	Acceptable	Siting	E
Steam stripping with Niles POTW discharge	Amenable	Proven, but impractical; storage not required	Consistent	Long-term	High	POTW may not accept	E
Carbon adsorption with Bame-Huntly discharge	Amenable	Proven, but impractical; storage not required	Consistent	Long-term	Acceptable	Siting	E
Carbon adsorption with Niles POTW discharge	Amenable	Proven, but impractical; storage not required	Consistent	Long-term	High	POTW may not accept	E

Table ~ (Cont'd)

Remedial Alternative	Site Conditions			Implementation Timeframe	Relative Cost	Environmental Consideration	Scre Decis
Alternative Drinking Water Supplies							
Howard Twp. Municipal Well Syst.	-	Pro		Short-term Permanent	>$1,000,000	Meets remedial action obj.	R
Connect to Niles Municipal Syst.	-	Prove		Short-term Permanent	>$1,000,000	Meets remedial action obj.	R
Install deepened Municipal Syst.	-	Proven	-	Short-term Permanent	< $1,000,000	Must confirm deep aquifer protected	R
Individual Domestic Well Treatment	-	Proven but limited	-	Short-term	< $1,000,000	Marginal	R
Provide Bottled Water to Affected Residence	-	Proven but not desirable	-	Short-term	Excessive Relative Cost	Socially unacceptable	E
Relocate Affected Residence	-	Not Feasible	No realistic solution, not consistent	Long-term Permanent	Excessive Relative Cost	Socially unacceptable	E

E = Eliminate from further consideration.

R = Retain for detailed evaluation.

increasing the flow to the existing air stripper.

On-Site and Off-Site Groundwater

No Action A: No treatment of on-site or off-site groundwater.

Not consistent with clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, reduce its volume or mobility, or provide a permanent solution. Also not consistent with the remedial action objectives established for this site.

Monitoring Only: Not consistent with clean-up criteria established by SARA of 1986: Does not destroy or detoxify waste, reduce its volume or mobility, or provide a permanent solution. Also not consistent with the remedial action objectives established for this site.

Collection with Purge Well(s) and Disposal by Off-site Deep Well injection: Excessive relative cost (approximately $2,000,000 to permit and install only). Not consistent with clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, or reduce its volume, excessive time required to obtain approval, if at all, (up to two years due to permit requirements).

Collection with Purge Well(s), and Discharge of Untreated Groundwater to a Surface Drain: Not consistent with clean-up criteria established by SARA of 1986. Does not destroy the waste, reduce its volume, or provide a permanent solution and is not consistent with remedial action objectives established for this site.

Provide Bottled Water to Affected Residents: Not consistent with clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, reduce its volume or mobility, or provide a permanent solution. The cost is excessive when compared to other alternatives.

Relocate Affected Residents: Not consistent with clean-up criteria established by SARA of 1986. Does not destroy or detoxify the waste, reduce its volume or mobility, or provide a permanent solution. The cost is excessive when compared to other alternatives.

VI. Description of Alternatives

Acceptable alternatives to address the remedial objectives at the U.S. Aviex site have two goals or objectives. First, they must control the on-site source of contamination, and second, they must control and treat the on-site and off-site contaminant plumes. The on-site control alternatives are directed toward sub-surface soil contamination through in-situ treatment or through leachate control by capping or excavation and incineration. An outline and discussion of these alternatives follows.

A. On-site Source Control - Soils
   1. In-situ treatment
      a. Aeration

b. Soil flushing
2. Leachate Control
a. Capping
b. Excavate and Incinerate
B. On-site Source Control - Groundwater
1. On-site Collection and Treatment, Off-site Disposal
a. Air Stripping
b. Steam Stripping
c. Carbon Adsorption
C. Management of Migration - On-site and Off-site Groundwater
1. On-site and Off-site Collection, On-site Treatment with Off-site Disposal

Alternative A.1.a. Aeration

An aeration system pulls air through the unsaturated soils, extracting volatile organic compounds (VOCs) from the pore spaces in the soil. The aeration equipment includes a system of air intake wells, air withdrawal wells, piping and a blower. Air intake wells are placed around the perimeter of the contaminated areas. Air withdrawal wells are placed in the center of the contaminated areas. A blower draws atmospheric air into the intake wells, through the soil pore space, and into the withdrawal wells. A vapor carbon absorber in line with the blower would remove the VOCs from the air before discharging into the atmosphere. A plastic membrane placed over the contaminated area ensures that air removed from the withdrawal well is drawn through the pore space and not from the surface near the withdrawal wells.

Alternative A.1.b. Soil Flushing

A soil flushing system removes VOCs from the contaminated soils by allowing water (possibly mixed with surfactants) to flow through the soil pore space. The contaminated water is then removed from the ground by the on-site purge wells and treated in the selected treatment system. Soil flushing takes place to some extent naturally due to the infiltration of rainwater in the cracks of the existing pavement that covers the contaminated areas. Soil flushing would be accomplished by an underground system of perforated pipelines below grade in the areas of contamination. The water supply could be obtained from an on-site well drilled to the uncontaminated aquifer or by connecting to the Niles Municipal Water System. The well would be constructed in such a way as to prevent contamination of the lower aquifer. Water (with a surfactant supplied through a chemical feed pump if required) would be continually applied to the subsurface soils.

Leachate production from the contaminated soils can be controlled by capping the surface to minimize surface water infiltration or eliminated by removing the soils.

Alternative A.2.a. Capping

The capping alternative reduces the permeability of the site surface,

minimizing infiltration. The multi-layered cap would consist of four feet of clay, a twenty mil PVC synthetic membrane, eighteen inches of sand, and six inches of top soil. The top of the cap would be seeded, mulched and fertilized. Post closure monitoring would be required to ensure continued effectiveness of the cap. The capping alternative would require excavation of approximately six feet of soil prior to installation because of site limitations. The excavated soil would be incinerated at a RCRA compliant facility.

Alternative A.2.b. Excavation and Incineration

Excavation of the contaminated soils is complicated by the depth of the soils to be removed and their proximity to buildings. Sheet piling will be necessary to protect the adjacent buildings during excavation. Since the required excavation depth, twenty feet, exceeds the depth that cantilever sheet piling may be used, a braced cofferdam system on all sides of the excavations will be necessary. Excavated soils would be disposed of at a RCRA approved landfill after treatment by incineration. The excavated area would be backfilled with off-site granular soils and the asphalt and concrete surfaces restored as required.

Alternative B.1. On-site Collection and Treatment with Off-site Disposal

On-site treatment can be accomplished with air stripping, steam stripping, or carbon adsorption. Off-site disposal options include discharge to the St. Joseph River via the Bame-Huntly Drain or to the Niles wastewater treatment plant POTW. All three treatment options require removal of the groundwater with on-site purge wells and from a separate well point purge area on-site designed specifically to capture the zone of DEE found and isolated on-site.

The following values were used as the basis of the design and cost analysis for each treatment system:

Flow Rate	270 gal/min
Temperature	55°F
Contaminant Loading	
1,2-DCA	150 ppb
1,1,1-TCA	150 ppb
1,1-DCE	3 ppb
Trans-1,2-DCE	18 ppb
PCE	<1 ppb
B-T-X (Benzene-Toluene-Xylene)	<1 ppb
DEE	210 ppb
TCFM	17 ppb
DCFM	<1 ppb

Effluent concentrations from each treatment system treating the 10^{-6} risk plume groundwater are estimated below:

Compound	Air Stripping	Steam Stripping	Carbon Adsorption

1,2-DCA	50 ppb	<1 ppb	<1 ppb
1,1,1-TCA	<1 ppb	<1 ppb	<1 ppb
1,1-DCE	<1 ppb	<1 ppb	<1 ppb
Trans-1,2-DCE	<1 ppb	<1 ppb	<1 ppb
PCE	<1 ppb	<1 ppb	<1 ppb
B-T-X	<1 ppb	<1 ppb	<1 ppb
DEE	70 ppb	<1 ppb	<1 ppb
TCFM	<1 ppb	<1 ppb	<1 ppb
DCFM	<1 ppb	<1 ppb	<1 ppb

This alternative will prevent migration of the contaminants off-site but it will not treat groundwater that has already migrated off-site. Groundwater monitoring will be used to assure that no further off-site migration occurs.

Alternative B.1.a. Air Stripping

Currently, the on-site collection and treatment of the groundwater is accomplished by an air stripping tower that discharges to the Bame-Huntley Drain. The air stripping process mixes large volumes of air with water in a packed column to promote the transfer of VOCs into the air. Groundwater from two purge wells is pumped to the top of a packed tower where it is distributed over a bed of plastic media. Air introduced at the bottom of the tower passes countercurrent to the groundwater, stripping the contaminants from the groundwater. The air containing the VOCs is currently released to the atmosphere because it meets Air Quality Standards.

To completely eliminate migration of the groundwater off-site, another purge well will be added to the existing two well system. Due to increased contaminant loading, it may also be necessary to add air controls to the emissions from the air stripping tower. Because of the increased groundwater purge rate, a larger air stripping column will be required.

Alternative B.1.b. Steam Stripping

A steam stripping treatment system is similar to an air stripping treatment system except that steam is the stripping media rather than air. The added heat increases the volatility of the contaminants. Additional equipment is also required to condense the steam.

Alternative B.1.c. Carbon Adsorption

A carbon adsorption treatment system involves filters the contaminated groundwater through two tanks filled with activated carbon. The contaminants absorb onto the carbon surface and are removed from the groundwater. Periodically the carbon must be replaced or regenerated.

In addition to the purge and on-site treatment and off-site disposal of the groundwater beneath the site, this alternative, as well as all of the pump and treat alternatives, must treat the leachate produced from the zone of isolated DEE contamination. This soil is located above a semi-isolated

shallow groundwater zone underlain by clay.

Effluent from any of the treatment options could be discharged to the Bame-Huntley Drain or to the Niles wastewater treatment plant. Discharge to the Bame-Huntley Drain would require a National Pollution Discharge Elimination System (NPDES) permit. U.S. Aviex has a NPDES permit for its present discharge. This permit would have to be modified for the increased flow and contaminant loading. To discharge to the Niles wastewater treatment plant, a pipeline must be constructed to the nearest sewer with adequate capacity for the flow. This sewer is located near the intersection of 17th and Oak Streets, approximately 2.5 miles from the U.S. Aviex site. Currently the wastewater treatment plant has sufficient capacity to accept the wastewater flow.

Flow rate and influent concentration would be identical to that of the on-site treatment alternatives. Off-site treatment would be at the Niles wastewater treatment plant. A pipeline would be constructed to discharge the purged groundwater to the plant. An existing sanitary sewer has adequate capacity to handle this flow.

Alternative C.1. Management of Migration of Groundwater, On-site Treatment with Off-site Disposal

This alternative may be divided into two options. The difference between the options is the extent of the contaminant plume capture. In the first option, the wells would be placed off-site to capture the 10^{-6} risk plume. In addition, one of the on-site wells would control the on-site leachate (4 wells total). A total volume of 500 gal/min of groundwater would be treated and disposed of. The second option would also use one on-site well but would involve four wells to control off-site leachate migration (5 wells total). These wells, placed at different locations than the wells in the first option, would collect groundwater at a rate of 620 gal/min, capturing the migrating flow from the primary contaminant plume. Each option also requires the wellpoint collection of 20 gal/min of on-site groundwater contaminated with DEE.

The following values were used as the basis for the design and cost analysis for each treatment system for the 10^{-6} risk plume:

Flow Rate	500 gal/min
Temperature	55°F
Contaminant Loading	
1,2-DCA	510 ppb
1,1,1-TCA	240 ppb
1,1-DCE	13 ppb
Trans-1,2-DCE	<1 ppb
PCE	<1 ppb
B-T-X	<1 ppb
DEE	900 ppb
TCFM	16 ppb

B-T-X	<1 ppb
DEE	900 ppb
TCFM	16 ppb
DCFM	<1 ppb

Effluent concentrations from each treatment system treating the 10^{-6} risk plume groundwater are estimated to be:

Compound	Air Stripping	Steam Stripping	Carbon Adsorption
1,2-DCA	160 ppb	<1 ppb	<1 ppb
1,1,1-TCA	<1 ppb	<1 ppb	<1 ppb
1,1-DCE	<1 ppb	<1 ppb	<1 ppb
Trans-1,2-DCE	<1 ppb	<1 ppb	<1 ppb
PCE	<1 ppb	<1 ppb	<1 ppb
B-T-X	<1 ppb	<1 ppb	<1 ppb
DEE	275 ppb	<1 ppb	<1 ppb
TCFM	<1 ppb	<1 ppb	<1 ppb
DCFM	<1 ppb	<1 ppb	<1 ppb

The following values were used as the basis for the design and cost analysis for each treatment system for the primary plume:

Flow Rate Total	620 gal/min
Temperature	55°F
Contaminant Loading	
1,2-DCA	150 ppb
1,1,1-TCA	240 ppb
1,1-DCE	12 ppb
Trans-1,2-DCE	<1 ppb
PCE	4 ppb
B-T-X	10 ppb
DEE	650 ppb
TCFM	13 ppb
DCFM	<1 ppb

Effluent concentrations for each treatment system treating the primary plume groundwater are estimated to be:

Compound	Air Stripping	Steam Stripping	Carbon Adsorption
1,2-DCA	50 ppb	<1 ppb	<1 ppb
1,1,1-TCA	<1 ppb	<1 ppb	<1 ppb
1,1-DCE	<1 ppb	<1 ppb	<1 ppb
Trans-1,2-DCE	<1 ppb	<1 ppb	<1 ppb
PCE	<1 ppb	<1 ppb	<1 ppb
B-T-X	<1 ppb	<1 ppb	<1 ppb
DEE	200 ppb	<1 ppb	<1 ppb
TCFM	<1 ppb	<1 ppb	<1 ppb
DCFM	<1 ppb	<1 ppb	<1 ppb

Each of these alternatives has several options. On-site treatment can be accomplished by air stripping, steam stripping, or carbon adsorption. Off-site disposal options include discharge to the St. Joseph River via the Bame-Huntley Drain or discharge to the Niles wastewater treatment plant as described earlier. In either collection alternative, 10^{-6} risk plume control or primary plume control, a groundwater monitoring program

will be implemented to ensure that the desired degree of plume capture is occurring.

An alternative with off-site treatment and disposal is also considered for the combined collection alternative. The collection is the same as above but flushing fluids discharge to the Niles POTW.

VII. Summary of the Comparative Analysis of Alternatives

The alternatives described above were found, in the FS screening, to merit detailed analysis. The analysis of these alternatives measured against the appropriate criteria follows.

1. **Overall Protection of Human Health and the Environment** addresses whether or not a remedy provides adequate protection, and describes how risks are eliminated, reduced or controlled through treatment engineering controls, or institutional controls.

The soil is treated to eliminate the risk from exposure through ingestion or inhalation of contaminated soil. Alternatives for treatment of the contaminated soil through in-situ treatment reduce the risk to the public health and the environment.

The capping alternative prevents exposure to contaminated soil and reduces the production of contaminated groundwater (leachate). The continued effectiveness of this alternative is dependent upon land use restrictions and maintaining the integrity of the cap.

The on-site treatment of contaminated groundwater alternatives reduce the risk to human health and the environment by eliminating the source of exposure as well as eliminating potential contamination of off-site groundwater. Restricting the use of on-site groundwater during the period of treatment eliminates the risk of exposure through ingestion.

Management of the migrating off-site groundwater contaminants through collection and treatment protects the public health and the environment. During the period of treatment, groundwater use will be restricted through institutional controls.

2. **Compliance with ARARs** addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements of other environmental statutes and/or provide grounds for invoking a waiver. ARARs are summarized in Table 8 for each alternative.

The Clean Air Act, 40 CFR 50 and 52, which implements and sets rules for regional air pollution control and establishes Ambient Air Quality Standards, is applicable to discharges of toxic substances to the atmosphere during waste handling or treatment. This Act is administered by Michigan Department of Natural Resources (MDNR) Air Quality Division under Michigan Act 348. The Air Quality Division is authorized to ensure that a person does not cause or permit the emissions of an air contaminant in quantities that will cause injurious effects to human health or safety,

animal life, plant life of significant economic value, or property "or unreasonable interference with the comfortable enjoyment of life and property." The Air Quality Division requires appropriate air monitoring of emissions and compliance with Federal PSD regulations, Federal NSPS, and NESHAP standards.

These standards will be met during treatment of soil and groundwater through the use of discharge control systems designed to meet the requirements of Rules 201 and 203 of Michigan Act 348. The capping and excavation and incineration alternatives will not meet Michigan Act 348 requirements and standards. However, only air monitoring to demonstrate compliance with Rule 901 of Act 348 has been required for installation of slurry walls.

The Clean Water Act 40 CFR regulates point discharges to navigable waters. This Act is administered by the MDNR under Michigan Act 245 and establishes surface water quality standards "to protect the public health and welfare, to enhance and maintain the quality of the water, to protect the State's natural resources." The MDNR oversees point discharge standards as promulgated by the Federal NPDES program under this Act. The groundwater treatment alternatives (air stripping, steam stripping, and carbon adsorption) will provide levels of efficiency meeting NPDES permit standards. Part 9 of Michigan Act 245 requires reporting of critical materials. At this site the defined critical materials include benzene, 1 DCA, Trichloroethylene, and Tetrachloroethylene. The alternatives will meet the requirements for an effluent discharge permit and the terms and conditions of the permits effluent standards and limitations.

The State has identified Michigan Act 245, Part 22, which regulates groundwater quality, as an ARAR. The purpose of the groundwater quality regulations is "to protect the public health and welfare and to maintain the quality of groundwater in all usable aquifers for individual, public, industrial and agricultural water supplies and provide for the nondegradation of groundwater quality in usable aquifers" by preventing discharge into the groundwater. Michigan Act 245 is not applicable since no discharges into the groundwater are proposed. Michigan Act 245 is not relevant or appropriate to establishing clean-up levels or areas of attainment at the site since no standards are provided. However, the groundwater treatment alternative proposes treatment to the 10^{-6} risk levels which will reduce contaminant concentration levels below the MCLs.

Installation of all wells in the aeration, flushing, and groundwater treatment alternatives will conform to Michigan Act 315 and the administrative rules which regulate construction, operation, and abandonment of such wells.

Michigan Act 98 regulates supervision and control over sewage systems including planning, construction, operation and maintenance. The groundwater treatment alternatives (air stripping, steam stripping and carbon adsorption) will meet the requirements of this Act.

Michigan Act 346 regulates inland lakes and streams. Act 346 requires

TABLE 8

ARARs FOR THE U.S. AVIEX SITE

Regulation	Requirement	Regulated Action or Condition	Alternative				
			A.1.a.	A.1.b.	A.2.a.	B.and C.	A.2.b.
FEDERAL							
Clean Air Act, Section 101	Implementation of regional air pollution control programs.	Emissions during excavation, treatment of soil and groundwater	X	X	X	X	X
40 CFR 52	Rules for implementation of regional air quality plan.	Emissions during excavation, treatment of soil and groundwater	X	X	X	X	X
40 CFR 50	Air quality standards.	Emissions during excavation, treatment of soil and groundwater	X	X	X	X	X
Clean Water Act, Section 208	Actions consistent with water quality management program.	Discharges to Bame-Huntley Drain		X		X	X
40 CFR 122	NPDES permit regulations.	Discharges to Bame-Huntley Drain		X		X	X
40 CFR 125	Criteria for NPDES permit.	Discharges to Bame-Huntley Drain		X		X	X
40 CFR 131	Enforcement jurisdiction over Discharges granted to States.	Discharges to Bame-Huntley Drain		X		X	X
40 CFR 136	Adherence to sampling Procedures.	Discharges to Bame-Huntley Drain		X		X	X
40 CFR 261	Definition and identification of hazards waste.	Excavated materials and groundwater treated residuals.			X	X	X
40 CFR 262	Regulations for generation of hazardous waste	Groundwater treatment residuals hauled off-site.				X	X
40 CFR 263	Regulations for transport of hazardous waste	Groundwater treatment residuals hauled off-site.				X	X

Table 8 (Page 2 of 3)

Regulation	Requirement	Regulated Action or Condition	Alternative				
			A.1.a.	A.1.b.	A.2.a.	B.and C.	A.2.b.
40 CFR 264 Subpart X	Standards for environmental performance of miscellaneous treatment units.	Physical/chemical treatment.					X
40 CFR 268 Subparts C and D	Land-banned waste materials.	Would apply to certain solvent-wastes.					X
40 CFR 403	Pretreatment standards for discharge to local POTW.	Discharges to POTW after installation of extraction wells but before installation of on-site groundwater treatment plant.				X	
40 CFR 141	Established maximum contaminant levels (MCLs) for drinking water quality.	Groundwater at the site.		X		X	
Executive Order 12372 40 CFR 29	Requires state and local coordination and review of EPA-assisted projects.	U.S. Avtex Site is a CERCLA site.	X	X	X	X	X
State							
ACT 348	Regulates air emissions and requires monitoring of air.	In-situ soil treatment RCRA, Cap	X	X	X	X	X
ACT 315	Regulates permitting, construction, and abandonment of wells.	Monitoring wells on-site and near site. Groundwater extraction wells.	X	X	X	X	X
Act 64 Part 2 and 3	Requirements for identification, recordkeeping, and management of hazardous waste.	Generated groundwater treatment residuals and excavated materials.			X	X	X

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Table 8 (Page 3 of 3)

Regulation	Requirement	Regulated Action or Condition	Alternative				
			A.2.a.	A.1.b.	A.2.a	B.and C.	A.2.b.
ACT 64, Part 5	Regulations for construction and licensing treatment facility.	Groundwater treatment		X			X
ACT 64, Part 6	Specifies technical standards for locating operating and closing a hazardous waste facility.	Groundwater treatment		X	X	X	X
ACT 245 Part 9	Rules for reporting discharges to state waters.	Discharges from groundwater treatment.		X		X	
ACT 245, Part 21	Rules for NPDES permit.	Discharges from groundwater treatment.		X		X	
ACT 98	Supervision and control of sewage systems	Construction and operation of groundwater treatment.				X	
ACT 346 Section 3	Permit for construction in "bottom land."	Buried pipeline for groundwater water collection and discharge.				X	
ACT 368	Authority to safeguard public health, determine imminent danger.	Any activity	X	X	X	X	X

compliance with permit regulations to "dredge or fill bottomland" or to "construct, enlarge, extend, remove, or place a structure on bottomland."

Act 346 specifies the technical information and criteria required for evaluating and reviewing the proposed activities. The construction of surface water discharge piping for disposal of treated groundwater will meet these requirements.

40 CFR 260-264 RCRA Subtitle C, regulates the generation, transportation, storage, treatment and disposal of hazardous wastes generated in the course of remedial action. The program is administered under Michigan Act 64. The Administrative rules requiring identification of hazardous wastes and compliance with management requirements will be met for carbon adsorption from the groundwater treatment alternative and for the emission control system of the air stripping or steam stripping alternatives. Requirements for construction and operation of a hazardous waste treatment facility in Part 5 and Part 6 of Michigan Act 64 will be met by the treatment alternatives.

The Safe Drinking Water Act, 40 CFR 141, establishes Maximum Contaminant Levels (MCLs) for drinking water quality. The treatment alternatives for on-site and off-site groundwater will meet the MCLs within the area of attainment based upon clean up levels of 10^{-6} total risk. Risks associated with the MCLs range from 10^{-4} to 10^{-6}.

3. **Long-term Effectiveness and Permanence** refers to the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

Both the soil flushing and the aeration alternative for on site soil source control provide long-term effectiveness and permanence through treatment. Under the soil flushing alternative levels of contamination are reduced until the generated leachate (flushing fluids) no longer acts as a source of groundwater contamination.

Aeration, through enhanced volatilization of the contaminants in the vadose zone, removes the source of the contamination. Leachate will no longer be produced.

The RCRA cap reduces the amount of surface water percolating through the contaminated vadose zone soil and the leachate production. Untreated contaminated soils will remain on the site, however, posing a long term threat to groundwater quality. The cap maintenance required also reduces the permanence of this alternative.

The excavation and incineration alternative effectively and permanently treats the contaminated soil on the site. Disposal of the ash off-site represents a future environmental hazard and adds to the problem of hazardous waste disposal.

The pump and treat alternatives provide for containment and treatment

of the on-site contaminant groundwater and the off-site plume, treating to levels which permanently reduce the potential for further degradation of the aquifer. The pump and treat alternatives also eliminate the health risks of consuming contaminated groundwater and reduce the threat to downgradient municipal wells. Discharge concentrations levels from the treatment methods comply with NPDES permit standards. When clean-up levels have been reached, this alternative will provide both long term effectiveness and permanence.

4. **Reduction of Toxicity, Mobility or Volume** is the anticipated perform- ance of the treatment technologies a remedy may employ. Toxicity of con- taminants in the on-site soil will be reduced through treatment. The soil flushing alternative reduces the potential for off-site movement of the contaminants from soil by treatment of the flushing fluids. Groundwater treatment through pump and treat alternatives reduces the contamination of groundwater under the site and controls migration of the off-site plume.

5. **Short-term Effectiveness** involves the period of time needed to achieve protection as well as the adverse effect on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Short-term effects of the in-situ soil source control alternatives would be negligible. Contaminants are immobilized in the subsurface area and carried to the surface for treatment by a closed circuit extraction system which minimizes the potential for risk to the public health and the environment. Treatment of the VOCs in the aeration alternative and contaminant-ladened fluid in the flushing alternative, operate in compliance with appropriate permit requirements.

The RCRA cap alternative introduces minor increases in the potential for exposure to subsurface soils and increases in the risk to the environment during the excavation period. The excavation and incineration alternatives could increase the risk of exposure to low levels of VOCs through either vapor emissions or particulate dispersion.

On-site groundwater source control and plume migration management alternatives depend upon groundwater usage restriction, in the form of advisories, for short term effectiveness. Emission treatment on the discharge side of the stripping tower will minimize exposure due to on-site treatment. The design of this system will mee. the technical requirements of applicable air emission control regulations.

Short term effectiveness of the on-site groundwater treatment alternatives assumes that discharges of treated water from the larger capacity stripping system required to treat the on-site and off-site groundwater and the soil flushing fluids, will remain within the limits of the NPDES permit in effect for the currently operating system.

6. **Implementability** is the technical and administrative feasibility of a remedy,including the availability of goods and services needed to

implement the chosen solution.

A purge and treat system for the groundwater is a necessary component of the in-situ treatment of soil contamination by soil flushing. This system may be difficult to design due to the stratigraphic variability at the site. A pilot study may be required to determine the number of wells, air flow rates, and other parameters.

While capping or excavation and incineration are available technologies for leachate control, a limiting factor is the availability of a landfill and incinerator.

On-site groundwater control and on and off-site management of migration alternatives, properly designed, will provide containment, collection, and treatment, and meet the objectives of site remediation.

Air stripping technology can be designed to improve removal efficiency to meet POTW pretreatment standard and NPDES permit requirements. Discharge alternatives require use of existing lines to surface drainage or the construction of a pipeline to the existing sewer line.

7. Cost includes capital, operation and maintenance costs.

Total costs for the alternatives other than no action are compared in Table 9 below.

TABLE 9

ALTERNATIVES	TOTAL COST
On-site Source Control of Soils	
In-situ aeration	$ 515,000
In-situ flushing	163,000
RCRA cap	1,003,000
Excavation and incineration	21,105,000
On-site Source Control of Groundwater with On-site Treatment and Off-site Disposal	
Air stripping	
surface discharge	$ 2,369,500
POTW	5,237,700
Steam stripping	
surface discharge	5,313,500
POTW	8,171,700
Carbon adsorption	
surface discharge	3,180,100
POTW	6,048,300
* Relevant only if there is a No Action Alternative for off-site groundwater treatment.	
Management of Plume Migration with Off-site and On-site Collection and On-site Treatment with Off-site Disposal	
Air stripping	

surface discharge	
10^{-6} plume	2,888,100
primary plume	3,359,500
POTW	
10^{-6} plume	7,348,900
primary plume	8,651,900
Steam stripping	
surface discharge	
10^{-6} plume	8,321,600
primary plume	10,390,300
POTW	
10^{-6} plume	12,772,400
primary plume	15,672,700
Carbon adsorption	
surface discharge	
10^{-6} plume	5,714,300
primary plume	6,023,200
POTW	
10^{-6} plume	10,175,300
primary plume	11,315,600

8. **Support Agency Acceptance** indicates whether, based on its review of the RI/FS, the support agency (State) concurs, opposes, or has no comment on the preferred alternative.

The State of Michigan has been notified of USEPA's choice of a preferred alternative and concurs with the selected alternative.

9. **Community Acceptance**

A Responsiveness Summary detailing USEPA's response to each significant comment submitted during the comment period is attached to the ROD.

VIII. The Selected Remedy

The selected remedy for the U.S. Aviex site, soil flushing (Alternative A.1.b.) and collection of on-site and off-site groundwater with treatment by air stripping (Alternative C.1.), addresses both sources of contamination and the resulting off-site plume.

Control of the sources of contamination will be accomplished by flushing the contaminants out of the vadose zone soil. These flushing fluids will then be collected along with the on-site contaminated groundwater through a system of purge wells. Control and collection of off-site contaminated groundwater will be accomplished by a series of purge wells installed in the contaminant plume. The collection system will be designed to contain the plume and prevent further degradation of the aquifer.

The design phase will include studies of sufficient scope to determine operating parameters and flushing system efficiencies. The

effectiveness of the flushing system will be evaluated after it has been in operation for five years. This evaluation will be based on an analysis of soil and groundwater samples for indicator chemicals. If there is no significant reduction in the contaminant levels in soils and if, after regular sampling and analysis, we find that the groundwater contamination continues to exceed 10^{-6} total risk, an alternate source control remedy will be identified in a new Feasibility Study and justified in a new Record of Decision.

The proposed area of attainment for treatment of the contaminated groundwater is the 10^{-6} total risk plume. This 10^{-6} total risk plume is that volume of water which contains contaminants at concentrations that pose an increased lifetime risk of one cancer case in a population of one million people. Restoration of the plume will meet drinking water standards, eliminating the risk to public health through consumption of contaminated groundwater. Impact, if any, on the Niles municipal wells approximately two miles west of the site will also be reduced.

Determination of the potential impact on the Niles municipal wells in the USEPA Endangerment Assessment was based on a worst case scenario - no action with continuous release of contaminants at the site. Using this scenario, analysis indicated that no contaminants of concern would be at unacceptable levels at the municipal wells at the time of arrival of the plume after approximately seventy years. The proposed alternative treats the sources of potential contamination and virtually eliminates any potential for impact on the municipal wells.

The contaminated groundwater collected from the on-site and off-site purge wells will be treated on-site by air stripping. The treated groundwater will be discharged to the surface waters through local drainage in compliance with NPDES permit requirements. The efficiency of this treatment alternative will produce an effluent with contaminant levels in an order of magnitude less than the chronic toxicity criteria. Appropriate monitoring of the effluent will insure that permit requirements are met during operation. Installation of purge wells and collection or discharge systems for off-site groundwater will meet state and local regulations regarding easements and construction standards. Discharge of VOCs to the atmosphere will be managed through emission controls designed to meet the requirements of state construction and operation air quality permits. Monitoring will insure that air quality standards are met.

There will be no additional risks to the community or on-site workers during the flushing, collection and treatment of the contaminated groundwater by the air stripper. Workers will use appropriate protective clothing (including respiratory protection) and adhere to an approved site safety plan.

The total estimated cost for the proposed remedies is $3,024,100. This estimated cost includes the on-site flushing of the contaminated soil ($163,000) and the cost of the treatment of on-site and off-site contaminated groundwater ($2,888,100).

IX. Statutory Determinations

Section 121 of CERCLA requires that, at a minimum, the selected remedy shall:

* Be protective of human health and the environment.
* Attain ARARs or provide grounds for invoking a waiver.
* Be cost-effective.
* Utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.
* Address whether the preference for a treatment that reduces toxicity, mobility, or volume as a principle element is satisfied, or provides an explanation as to why it is not satisfied.

A. Protection of Human Health and the Environment

The existing and potential risk to human health come about through exposure to contaminated groundwater and from the off-site plume through consumption and domestic use. This risk is limited to accidental or uninformed use only, since a municipal water system has been extended into the affected area. On a long term basis, there is the potential for exposure beyond the current area of contamination if the plume continues to migrate. The selected remedy eliminates potential risks and ensures adequate protection of human health and the environment through containment and treatment of the on-site plume within the area of attainment to 10^{-6} risk levels. This level of treatment represents contaminant levels which, at a minimum meet drinking water standards.

Short term risks may be posed during the treatment process by the discharge of treated water to surface drainage and by emissions to the atmosphere from the air stripper. However, the treatment process will, treat groundwater to levels which will meet the NPDES permit requirements and cause no unacceptable short term risks by implementation of the remedy. Atmospheric emissions will meet the standards of the Federal and State Air Pollution Control Acts.

B. Attainment of Applicable or Relevant and Appropriate Requirements

The applicable or relevant and appropriate Federal and State requirements (ARARs) that were considered for the U.S. Aviex site and satisfied through the selected remedy are listed in Table 10. The selected remedy attains Federal and State ARARs.

Chemical specific ARARs address the clean up levels for indicator

TABLE 10

U.S. Aviex
Selected Remedy ARARs

I. Federal Requirements	
A. Groundwater Protection	
1. Clean up levels for indicator chemicals (Benzene, TCE, 1,2-DCA, 1,1-DCE, 1,1,1-TCA)	40 CFR 141
B. Surface Water Protection	
1. Regional management program	CWA, Section 208
2. NPDES - discharge of treated groundwater	40 CFR 122 40 CFR 125 40 CFR 131 40 CFR 236
C. Construction of Treatment System and Disposal of Treatment Residuals	40 CFR 260-263
D. Protection of air quality during Treatment	Clean Air Act, Section 101 40 CFR 50, 52
E. Generation, Transportation, Storage, Treatment and Disposal of Hazardous Wastes	RCRA Subtitle C 40 CFR 260-264
II. State of Michigan Requirements	
A. Surface Water Protection	
1. Discharges from groundwater treatment	Act 245, Part 9, 21
B. Air Quality Protection	Act 348
C. Treatment System Installation	Act 98 Act 846, Section 3 Act 315
D. Treatment Residuals	Act 64, Parts 2, 3, 5, 6
E. Hazardous Wastes	Act 64

micals. The Safe Drinking Water Act, 40 CFR 141, establishes maximum contaminant levels (MCLs) for drinking water quality. MCLs will be reached or exceeded within the 10^{-6} risk level area of attainment. Action specific ARARs relate to the installation and operation of the groundwater collection and treatment alternative, the discharge of treated groundwater, air emissions, and disposal of treatment generated wastes.

Permit requirements for installation of wells in the groundwater collection system pursuant to Michigan Act 315, are relevant and appropriate and will be met. RCRA Subtitle C, 40 CFR 260 through 264 and 40 CFR 100 through 199, regulate the generation, transportation, storage, treatment, and disposal of hazardous wastes generated in the course of remedial action. The construction design, monitoring operation, and closure of hazardous facilities is also regulated. This program is administered by MDNR under Act 64. The requirements are applicable to the groundwater system and to the disposal of treatment residuals. These requirements will be met.

Discharge of treated groundwater to surface waters is regulated by the Clean Water Act Section 402, 40 CFR 122 and 125, Subchapter N, National Pollution Discharge Elimination System (NPDES) which regulates point discharges to navigable waters. The Clean Water Act is administered by MDNR under Michigan Act 245. NPDES requirements apply to discharges to the Bame-Huntly drain. Treated waters will be discharged at levels which meet permit requirements.

The Clean Air Act, 40 CFR 50 and 52, implements and sets rules for the regional air pollution control program and establishes Ambient Air Quality Standards. The program is administered by the MDNR under Michigan Act 348. These requirements are applicable to air emissions generated during treatment of groundwater. Emissions during operation of the air stripper will be monitored and controlled to comply with Federal PSD regulations, Federal NSPS and NESHAP standards, and permitting requirements.

C. Cost Effectiveness

Total cost for the selected remedy is $3,024,100. The soil flushing alternative for treatment of contaminated soil is $163,000 and the treatment of on-site and off-site contaminated groundwater is $2,888,100. This remedy provides the best overall effectiveness commensurate with costs such that it represents the most reasonable value for the money.

A discussion comparing other alternatives considered for treatment of on-site soil contamination follows below:

Aeration	$	515,000
RCRA Cap		1,003,000
Excavation and Incineration		21,105,000

Costs for the RCRA cap are one order of magnitude greater than the

selected remedy and offer less protectiveness. Incineration is two orders of magnitude greater than the preferred remedy and offers no increase in protectiveness. The cost differential between aeration and soil flushing is a factor of two with no increase in protectiveness for the aeration alternative.

. Costs for collection of groundwater for on-site and off-site control of migration are the same for each of the treatment alternatives. Costs vary according to the treatment applied, the method of disposal, and the volume of treated groundwater. No advantage in protectiveness results from disposal at the POTW over discharge to surface waters. Both methods of disposal meet NPDES permit requirements for discharge to surface waters. The groundwater is treated to meet 10^{-6} risk levels providing protectiveness to meet or exceed drinking water standards. Treatment costs for contaminated groundwater are compared below:

Air stripping	$ 2,888,100
Steam stripping	8,321,600
Carbon adsorption	5,714,300

D. Utilize Permanent Solutions and Alternative Technologies

The selected remedy provides a permanent solution employing alternative treatment or resource recovery technologies to the maximum extent practicable and provides the best balance among the nine evaluation criteria of all the alternatives examined. The remedy is the most appropriate solution for the site. The in-situ soil treatment alternative satisfies the preference for a permanent solution, alternative treatment technology, and attains ARARs. The soil flushing alternative demonstrates an advantage over the aeration alternative because of site conditions which may reduce the effectiveness of the aeration alternative.

Design efficiencies for each of the treatment alternatives will meet surface discharge permit requirements. Air stripping affords overall effectiveness equal to the steam stripping and carbon adsorption alternatives and is the most cost effective.

Groundwater treatment alternatives also satisfy the preference for permanent solutions and alternative technology and attain ARARs. The air stripping alternative is the most cost effective. The remedy satisfies the preference for treatment that addresses the principal threats posed by the site.

E. Reduction of Toxicity, Mobility or Volume

Toxicity of contaminants in the on-site soil will be reduced through treatment. The soil flushing alternative reduces the potential for off-site movement of the contaminants from soil by treating the soil and the flushing fluids. Groundwater treatment through pump and treat alternatives reduces the contamination of groundwater under the site and controls migration of the off-site plume.